SIEMENS

MAMMOMAT *Novation*^{DR}

SP

System

Startup

with WH AWS, from System Serial No. 1101

© Siemens AG 2004
The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

English
Print No.: SPB7-250.815.03.01.02
Doc. Gen. Date: 09.04
Replaces: n/a

Document revision level

The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.

Please contact your local Siemens office to order current revision levels.

Disclaimer

The installation and service of equipment described herein is to be performed by qualified personnel who are employed by Siemens or one of its affiliates or who are otherwise authorized by Siemens or one of its affiliates to provide such services.

Assemblers and other persons who are not employed by or otherwise directly affiliated with or authorized by Siemens or one of its affiliates are directed to contact one of the local offices of Siemens or one of its affiliates before attempting installation or service procedures.

Contents 0 - 3

Page

1 Prerequisites 1 - 1

Configuration . . . 1 - 1
Meters, appliances and tools . . . 1 - 2
Auxiliary Materials . . . 1 - 2
Phantoms / Auxiliary . . . 1 - 3
Tools . . . 1 - 3

2 Important Notes 2 - 1

Symbols . . . 2 - 1
Factory Adjustments . . . 2 - 1
Special checks and protocols . . . 2 - 1
Acceptance Test . . . 2 - 1
Protective measures . . . 2 - 2
System Power Supply . . . 2 - 2
PC Boards . . . 2 - 2
Metal Curtain . . . 2 - 2
Measurements with the oscilloscope . . . 2 - 3
Swivel-arm rotation . . . 2 - 3
Service Software . . . 2 - 3
Delay times between two exposures . . . 2 - 4

3 Power up the MAMMOMAT Stand 3 - 1

Radiation protection door switch (optional) . . . 3 - 1
External exposure lamp (optional) . . . 3 - 1
Mains voltage . . . 3 - 2
Electrical power to mains input: . . . 3 - 2
Connections: . . . 3 - 3
Measuring the line resistance . . . 3 - 4
Checking the supply voltages . . . 3 - 4
Checking the microprocessors LED's . . . 3 - 5
Startup of the MAMMOMAT Stand . . . 3 - 5
Startup of the Acquisition Workstation . . . 3 - 6
Arranging the swivel arm . . . 3 - 6

4 Detector installation 4 - 1

Unpacking of the detector . . . 4 - 1
Mounting the detector . . . 4 - 4
Mounting the grid . . . 4 - 5
Adjusting the switches . . . 4 - 6
Mounting the covers . . . 4 - 6

5 Mechanical Checks 5 - 1

Mounting covers . . . 5 - 1

Page

Cable duct covers . . . 5 - 1
Swivel arm covers . . . 5 - 1
Side covers . . . 5 - 1
Front cover . . . 5 - 2
Stand covers . . . 5 - 3
Face shield . . . 5 - 4
Mechanical Checks . . . 5 - 5
Rotary motion . . . 5 - 5
OPDIMA wing . . . 5 - 6
Vertical adjustment . . . 5 - 7
Emergency stop . . . 5 - 7
Disable Film Exposure . . . 5 - 8
Checking the field light time . . . 5 - 9
Adjusting the field light time . . . 5 - 10
Checking the compression device . . . 5 - 10
Decompression button . . . 5 - 12
Checking the OPCOMP . . . 5 - 12
Checking the exposure blocking . . . 5 - 13

6 X-ray tube checks 6 - 1

Tube high voltage, current and mAs values . . . 6 - 1
Preparation . . . 6 - 1
Measurement method . . . 6 - 1
Checks with a large focus and without AEC . . . 6 - 3
Checks with a small focus and without AEC . . . 6 - 4
Checks with a large focus and with AEC . . . 6 - 5

7 Collimator Adjustment 7 - 1

Automatic collimator . . . 7 - 1
Collimator reference axis . . . 7 - 1
Collimator beam check and calibration . . . 7 - 2
Collimator beam calibration . . . 7 - 2
Collimator field light calibration . . . 7 - 4
Collimator Wing Difference Calibration . . . 7 - 5

8 Checking dose settings 8 - 1

Enable/Disable Dose Calculation . . . 8 - 1
Configuring of Dose Calculation System . . . 8 - 1
Label . . . 8 - 2
Checking OPDOSE . . . 8 - 3
Checking the AEC dose settings . . . 8 - 4
Checking the H & D dose settings for Mo/Mo . . . 8 - 4
Check the H & D dose settings for Mo/Rh and W/Rh . . . 8 - 7
Adjust the H and D Settings . . . 8 - 8

9 Image Quality 9 - 1

Page

Checking Grid Lines . . . 9 - 1
Checking visibility of grid lines . . . 9 - 1
Measuring grid lines . . . 9 - 3
Eliminating Grid lines . . . 9 - 4
Checking Image Quality . . . 9 - 8
Calibration of detector . . . 9 - 8
Creation of new pixel map . . . 9 - 14
Quality Control Manual Tests . . . 9 - 20

10 Final procedures 10 - 1

Settings date and time. . . . 10 - 1
MAMMOMAT Stand . . . 10 - 1
BRICK . . . 10 - 1
Service PC and measuring instruments. . . . 10 - 3
Saving the configuration file . . . 10 - 3
Reset the exposure counter . . . 10 - 3
Deleting the error buffer . . . 10 - 3
Saving the MAMMOMAT Parameters . . . 10 - 3
Remove the measuring instruments. . . . 10 - 3
Checking the protective grounding resistance. . . . 10 - 3
Warning label on control panel . . . 10 - 4
Quality Certificate . . . 10 - 4

11 Startup Protocol 11 - 1

Site Data. . . . 11 - 1
Auxiliary Materials used . . . 11 - 1
Installation and Start up steps performed . . . 11 - 2
Startup Settings . . . 11 - 4
Tube high voltage, current and mAs values . . . 11 - 4
Collimator beam calibration . . . 11 - 6
Collimator field light calibration . . . 11 - 6
Collimator wing difference . . . 11 - 6
AEC Dose Settings . . . 11 - 6
OPDOSE Settings . . . 11 - 7
Checking Grid Lines . . . 11 - 7
Activity report . . . 11 - 8
General remarks. . . . 11 - 9

12 Appendix 12 - 1

Troubleshooting Image Quality . . . 12 - 1
Working with the service PC . . . 12 - 4
Description of the syntax used in these instructions. . . . 12 - 4
Connecting the service PC . . . 12 - 5
Configuration of the service PC . . . 12 - 5
Configuration of computer BIOS. . . . 12 - 5

Page

Configuration of Windows® 2000 Pro . . . . . .12 - 5
Starting up and using the service PC . . . . . .12 - 6
Troubleshooting PC connection . . . . . .12 - 6

13 _____ Changes to previous version _____13 - 1

Configuration

The configuration of the MAMMOMAT *Novation*^{DR} installation depends on the customer's choice.

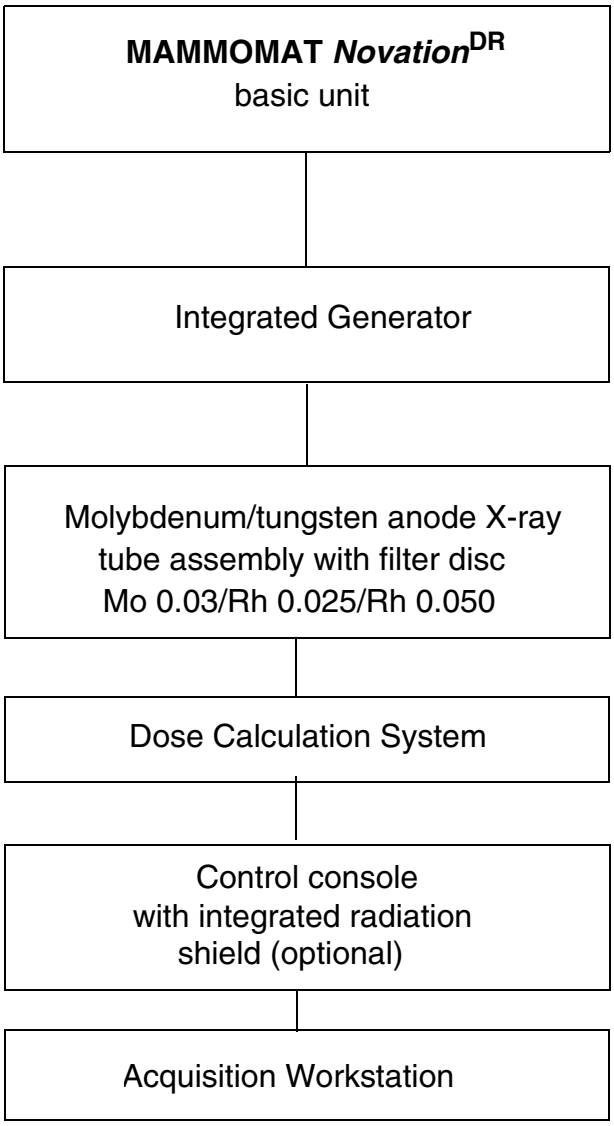

MAMMOMAT *Novation*DR
basic unit
Integrated Generator
Molybdenum/tungsten anode X-ray tube assembly with filter disc Mo 0.03/Rh 0.025/Rh 0.050
Dose Calculation System
Control console with integrated radiation shield (optional)
Acquisition Workstation

Fig. 1 Configuration

Unless otherwise stated, these instructions describe the

- MAMMOMAT *Novation*^{DR} Stand with the integrated generator,
- radiation shield with the integrated control console
- detector and
- Acquisition Workstation (WH AWS).

Depending on the installation configuration, some points may be omitted.

Meters, appliances and tools

Auxiliary Materials

NOTE	Calibrated instruments are required.

Item	Remarks	Material Number	With System
Oscilloscope >50MHz with memory	e.g. TEKTRONIK 314		no
Digital multimeter including an mAs meter	e.g. FLUKE 8060A or FLUKE 87	97 02 101 97 03 976	no
Service PC	See the CS Intranet (**CS/For Service/Common Services/Service Laptop for CSEs)** for details.		no
Power line impedance meter		84 28 104	no
Power ground-wire tester		44 15 899	no
Luminance meter (for monitor calibration)	e.g. Mavo Monitor or Wellhöfer LXplus (05 146 167)	97 02 432	no
Luminance meter (measures the light intensity from the X-ray field)	e.g. SMfit Mammo	88 81 281	no
Dose meter	e.g. Solidose	88 81 323	no
Ion chamber	For dose meter Solidose	88 81 315	no
Densitometer	e.g. X-Rite 331	97 02 416	no
A non-invasive digital kV meter	If not available in the district, a scope can be used instead		no

Tab. 1 Meters, appliances and tools

Phantoms / Auxiliary

Item	Remarks	Material Number	With System
RMI 156		88 81 265	no
Three, 2 cm plexi (PMMA)		65 61 232	yes
2 mm steel plate, 30x25 cm		66 55 851	yes
2 mm steel plate, 3x10 cm		66 55 844	yes
One 0.1 mm, two 0.2 mm and one 0.5 mm sheets of aluminum 99% (1100) alloy, 4x4 cm		88 81 273	no
Mammography line pair phantom	2-10 lp/mm	88 81 299	no
Collimator mounted plexi (4 cm)			yes
Compression plate simulator			yes
4.2 cm plexi	Size of the detector	74 47 720	no
Ethernet cable			no
Serial PC cable	RS232 / Array / BRICK	66 55 745	yes
Serial PC cable	RS232 / Stand	99 00 440	no
Cassette / Film 24x30 cm			no
Centering cross		96 60 051	no

Tab. 2 Phantoms and auxiliaries

Tools

Item	Remarks	With System
Standard installation and service tools		no
Torque wrench for bolting the stand/ console to the floor		no
Electrical screwdriver with adjustable torque is recommended		no

Tab. 3 Tools

This page intentionally left blank.

Symbols

This symbol indicates exposure of X-ray radiation.

This symbol indicates that the measured values have to be entered in the "Startup Protocol" on page 11 - 1.

Factory Adjustments

The **MAMMOMAT *Novation*^{DR}** is adjusted, programmed and tested in the factory, leaving the adaptation to the on-site mains voltage, adjustment of the AEC and the functional tests to be performed.

When the measurements to be made (kV, mAs, etc.) are within the tolerances stated in these instructions, this confirms that the settings made in the factory have not changed and the equipment is fully serviceable.

The equipment tested with **400 V, 2-phase** in the factory.

Special checks and protocols

Acceptance Test

The acceptance test of the MAMMOMAT *Novation*^{DR} is recommended to be performed whenever a new MAMMOMAT *Novation*^{DR} system has been installed and whenever changes that might affect performance have been made to an existing system.

The acceptance test of MAMMOMAT *Novation*^{DR} involves performance of all QC procedures in this **Quality Control Manual (**SPB7-250.623.02...) ensuring that a basic minimum image quality criteria is met before the system is used with patients.

All yearly tests from the **Quality Control Manual** have to be performed.

Depending on the country where the system is installed, additional tests have to be performed.

- RöV §16 regulations have to performed in **Germany**.
- The DHHS regulations have to be performed in the **USA**.
  Maintenance measurements must be made according to the **DHHS Maintenance Instructions** (SPB7-250.662.01...) and the **DHHS Supplements to the instructions for use** (SPB7-250.661.01...). Results must be recorded in **DHHS Measurement certificates** (SPB7-250.663.01...).

Protective measures

System Power Supply

It is very important that any intervention in the equipment will start with disconnecting it from the power supply with the main circuit-breaker. Before removing or inserting any of the printed circuit boards, switch off the equipment.

⚠WARNING	**If the system is only switched off at the control panel, the line voltage will still be present at the generator line connection (see wiring diagram).** **A life-threatening hazard of electric shock exists.**

⚠WARNING	**After shut-down of the system, there may still be 380 V DC present on the intermediate circuit.** **A life-threatening hazard of electric shock exists.**

PC Boards

⚠CAUTION	**The p.c. boards contain electrostatic highly sensitive components.** **If disregarded, the components could be damaged.** **Use ESD equipment, ground prior to making contact and place the components on a conductive surface.**

Metal Curtain

⚠WARNING	**The edges of the metal curtain of the stand are very sharp.** **They may cause severe injury.** **These strips must always be applied onto the edges of the metal curtain during service and maintenance work.**

Apply the protective strips after removing the covers from the stand. Remove the protective strips only when the covers are to be mounted or when vertical adjustment of the swivel arm system is necessary.

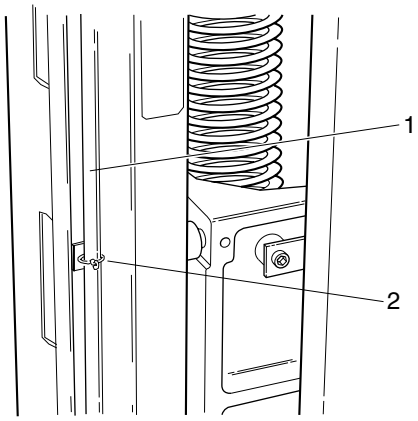


Fig. 1 Protective strips for the metal curtain

Holders (2/Fig. 1) for storing the protective strips when not in use are provided on both sides of the curtain.

Measurements with the oscilloscope

⚠WARNING

The existing ground conductor in the mains cable must under no circumstances be disconnected when operating the oscilloscope.

A life-threatening hazard of electric shock exists.

For measurements in which a resulting ground loop may falsify the measuring result, use the differential amplifier (difference measurement).

Swivel-arm rotation

⚠WARNING

Never rotate the swivel arm with the detector wing in the parking position. This will damage the main cable harness.

Service Software

The MAMMOMAT *Novation*^{DR} has various service software packages:

- Acquisition Workstation
  The Acquisition Workstation service software is web-based and can be started from the Options application menu.
- BRICK
  The BRICK service software can be accessed via the Acquisition Workstation.

- MAMMOMAT stand.
  The Service PC is required for MAMMOMAT stand service software.

NOTE

When the generator is switched off with the service PC connected, wait approximately 5 seconds before switching it on again (The LED's H3 and H4 have to be off).

A description of the various service software packages can be found in the MAMMOMAT *Novation*DR manual "Software" (**SPB7-250.816.02...**).

Delay times between two exposures

The delay times listed below must be followed to prevent the tube from overheating.

Exposure mAs value	Delay time between two exposures (seconds)
max. 100	min. 15
max. 200	min. 30
max. 300	min. 45
max. 400	min. 60
max. 500	min. 75

Tab. 1 Delay times between two exposures

Radiation protection door switch (optional)

It is optional to connect a radiation protection door switch to the MAMMOMAT *Novation*^{DR} master board D750 connector X754.

NOTE	**A radiation protection door switch is not delivered with the MAMMOMAT *Novation*^{DR}.**

A 15V / 5 mA signal is used in the door switch circuit. When the signal path is opened by the door switch, the exposure will immediately be terminated.

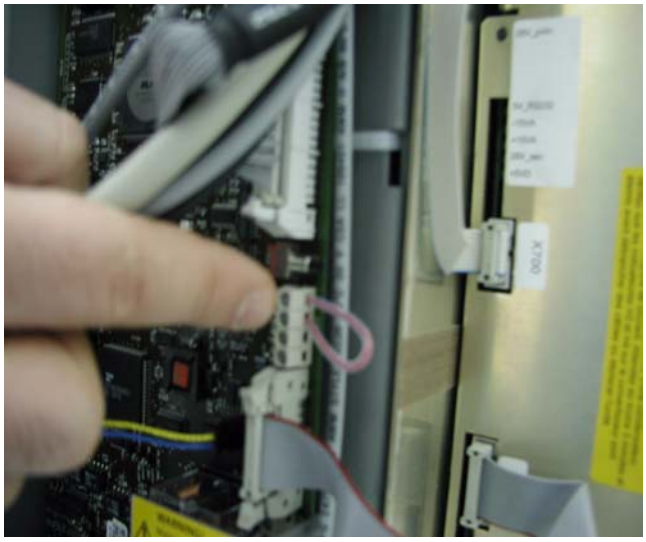


Fig. 1 Connecting the door switch

1. To connect a door switch, remove the jumper from the X754 (Pin 1,2) located on the master board D750, see Fig. 1, and connect the door switch instead.

If a radiation protections door switch is not used, a jumper, see Fig. 1, on the master board 750 at connector X754 (Pin 1,2) has to be inserted.

External exposure lamp (optional)

This should only be performed if the customer requires it.

The connection on the Master board works as a shutter. The signal from the Master board is only active during exposure, thus the exposure lamp will only be lit when the signal is active.

Connect the cable to the lamp holder in series with the power supply.

⚠CAUTION	**When connecting the exposure lamp to the Master board, make sure that the electrical load does not exceed 24VAC / 25W**

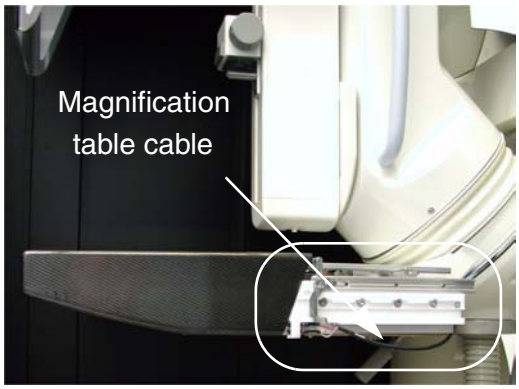
1. Connect the exposure lamp to the connector X759 located on the Master board D750, see Fig. 2.

Fig. 2 Connecting the exposure lamp

NOTE **Do not use power from the MAMMOMAT stand.**

Mains voltage

⚠WARNING **Before the power for the MAMMOMAT is turned on, make sure, that the cable plugs (left and right of the system) for the Magnification table are not shorted.**



The mains input can be either 1-phase or 2-phase, 50 or 60 Hz.

Electrical power to mains input:

Mains voltage	1-phase:	208, 230, 240 and 277 V ±10%
	or	
	2-phase:	208, 230, 240, 277 and 400 V ±10%
Mains Frequency:	50 or 60 Hz	
Maximum load:	10kVA (momentary) and 0.8 kVA (long time load).	
Fuse:	25 A (external) 208 -> 400 V.	

Connections:

Power system	Type of connection	Power voltage	Power connections
Single phase	Phase to neutral	208 V-277 V	Connect to **3** and **4** (see No.1/ Fig. 3)
Two phase	Phase to phase	208 V-400 V phase to phase. Note: Max 277 V phase to neutral/ ground allowed.	Connect to **3** and **4** (see No.1/ Fig. 3). Use two phases (of three) in a normal power distribution system.The left over wires, neutral and the third phase may be connected to terminal **1** and **2**. See Fig. 3.

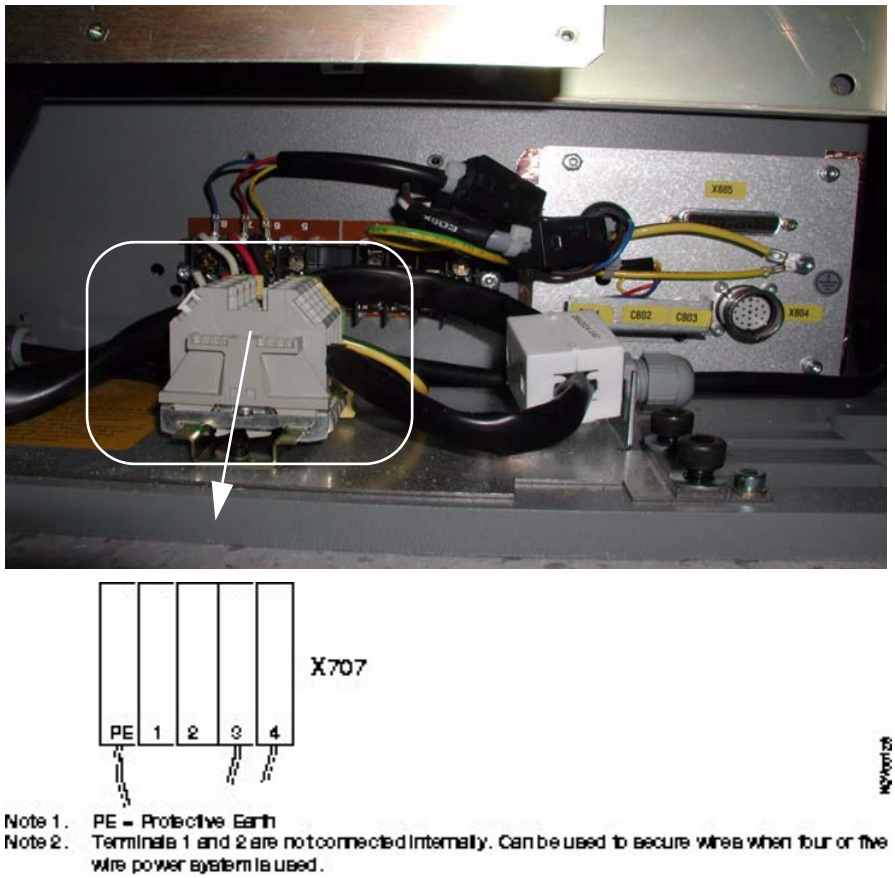

X707
PE
1
2
3
4
Note 1. PE = Protective Earth
Note 2. Terminals 1 and 2 are not connected internally. Can be used to secure wires when four or five wire power system is used.

Fig. 3Incoming mains cable

1. Connect the incoming mains cable to the mains terminal (Fig. 3) at the bottom of the back of the stand.
2. Strain-relieve the incoming mains cable.

Measuring the line resistance

1. Connect the line resistance meter to the mains input terminal on the stand.
2. Mains supply **ON**.
3. Carry out measurement.
4. Mains supply **OFF**.

To achieve the maximum output, the line resistance must not exceed the following values:

Nominal Input Voltage [VAC]	Line Resistance Ri_{max} [Ω]
208	0,45
230	0,50
240	0,60
277	0,65
400 (2-phase)	0,85

Tab. 1 Measuring the line resistance

Checking the supply voltages

The correct supply voltages +5 V, +15 V and +28 V have already been tested in the factory. Only a visual check of the function is therefore needed.

1. Switch the system **ON**.
2. Check that the following LED indicators (top to bottom) on the mains input converter (generator) are on:

LED check
28 VP
5 VF
- 15 V
+ 15 V
28 VS
5 V

Tab. 2 LED check

Checking the microprocessors LED's

The following LED's on the microprocessor p.c. boards (D750) indicate whether the relevant microprocessors are operating correctly.

1. Mains **ON**.
2. Check that the CPU IC107 status LED's D13, D14, D15 are continuously **ON** and LED D16 is **OFF** for approximately. 1 second after the mains is switched on.
3. Switch the MAMMOMAT *Novation*^{DR} system power **ON** by pressing the **ON** button on the control console. After approximately. 5 seconds check that the CPU IC107 status LED D13 is rapidly flashing and the LED's D14, D15 and D16 are **OFF**.
4. Check that LED D25 on the master board D750 is flashing slowly (once per second).

Startup of the MAMMOMAT Stand

1. Make a note of the exposure parameters.
2. Shutdown the MAMMOMAT system completely.
3. Turn the external power switch **ON**.
4. Check that the power up of the Generator and the BRICK are performed properly.
5. Start the MAMMOMAT system by pressing the power button **ON** on the control console.
6. Check that the MAMMOMAT system is powering up correctly.
7. Check that the BRICK and the Acquisition Workstation communication is working properly (LED's V2 and V3 need to be green on the BRICK).The PXCM includes three status LEDs:

   V1—Fiber-optic communications status. A red LED that lights to indicate lack of communication from the DROC. Likely causes are misconnected fiber optic lines or the Detector being turned off.

   V2—PXCM status. A green LED that flashes to indicate normal operation of the PXCM. If this LED does not light for a significant amount of time (that is, 2 to 3 minutes), restart the system.

   V3—Power status. A green LED that lights to indicate that the PXCM is providing power to the Detector.
8. Check that the operating mode **dr** is displayed on the control console**.**
9. Check if the noted exposure parameters are restored correctly.

Startup of the Acquisition Workstation

System specific data has to be entered and set.

The startup and configuration of the Acquisition Workstation is described in the document **Startup, WH AWS** (SPB7-250.815.02...).

Arranging the swivel arm

1. Remove the protective strips from the metal curtain.
2. Run the lifting carriage upwards.
3. Attach the protective strips back onto the metal curtain.
4. Rotate the swivel arm system to **0 degrees** by pressing one of the switches for clockwise rotation on the supporting arm.
5. Unlock the wing and move the film wing to the parking position.
6. System and mains **OFF**.

Unpacking of the detector

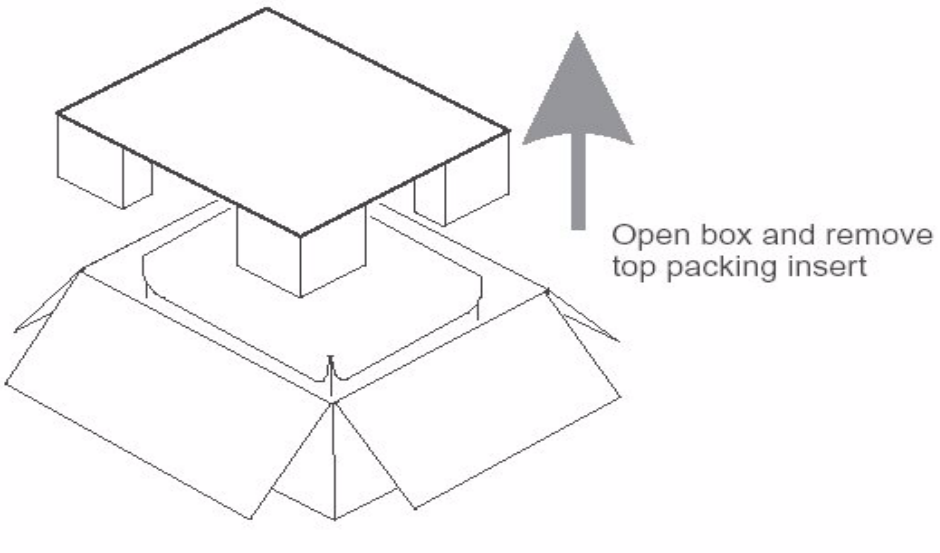


Fig. 1 Opening the cardboard box

1. Open the cardboard boxes and remove the top packing insert.

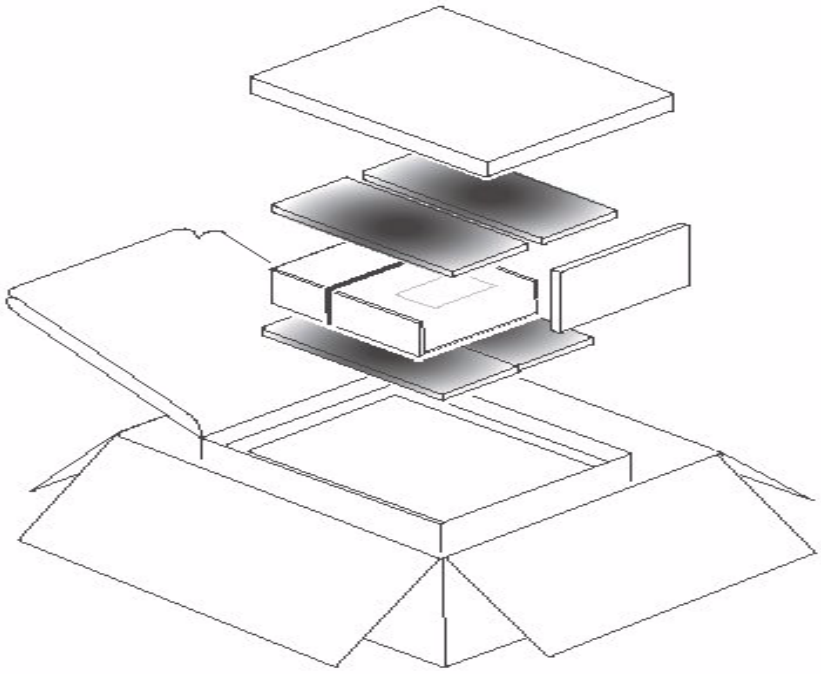


Fig. 2 Opening the box

1. Remove all of the other packing material covering the inner box in which the detector is located.

NOTE	**Do not cut the lifting band.**

Fig. 3 Lift out the inner box

1. Lift the inner box from the large box by pulling up on the lifting band.

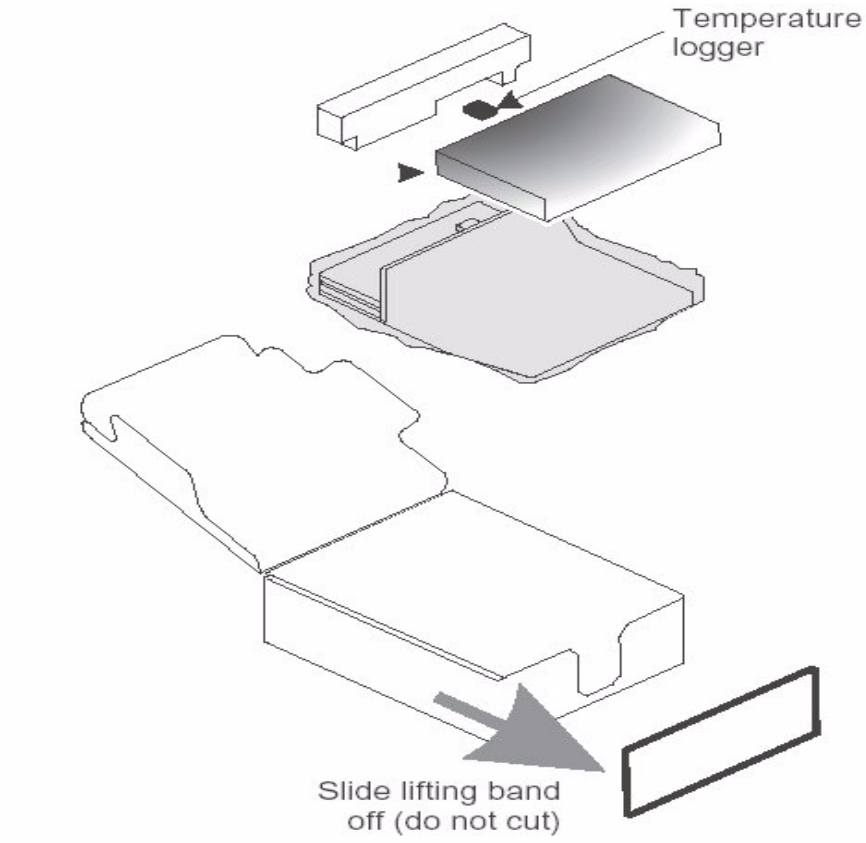


Fig. 4 Remove packing material

1. Slide the lifting band from the inner box.
2. Lift out the detector and carefully remove from wrapper.

3. Open box, remove packing insert, temperature logger and phase change material.
4. Remove the packing material inside the inner box, which includes the temperature logger that is used to ensure that the detector maintained the proper temperature while being shipped and stored.
5. Carefully remove the detector from its protective bag.

⚠CAUTION

Handle the detector with extreme care!

Avoid touching the thin film top cover that protects the imaging area. The imaging electronics under the front cover are extremely sensitive. The actual image area starts at the front edge and is approximately 25 mm inside the other three edges.

Any dust or fingerprints in this area may affect final image quality. Temperature extremes may cause permanent damage.

6. Check the temperature logger with a ball pen, as shown in (Fig. 5).

Fig. 5 Check temperature logger.

NOTE

When the LED lights green, transportation was OK and the detector can be installed.
When the LED lights red, the detector is defective and has to be replaced.

NOTE

You have to send the temperature logger to the factory, using the regular Customer Services return process.

You'll find all documents required for sending it enclosed in the detector package (black box).

Enter the detector serial number, your district address and installation date before you send it.

NOTE

The detector package has to be disposed of locally after the installation.

Mounting the detector

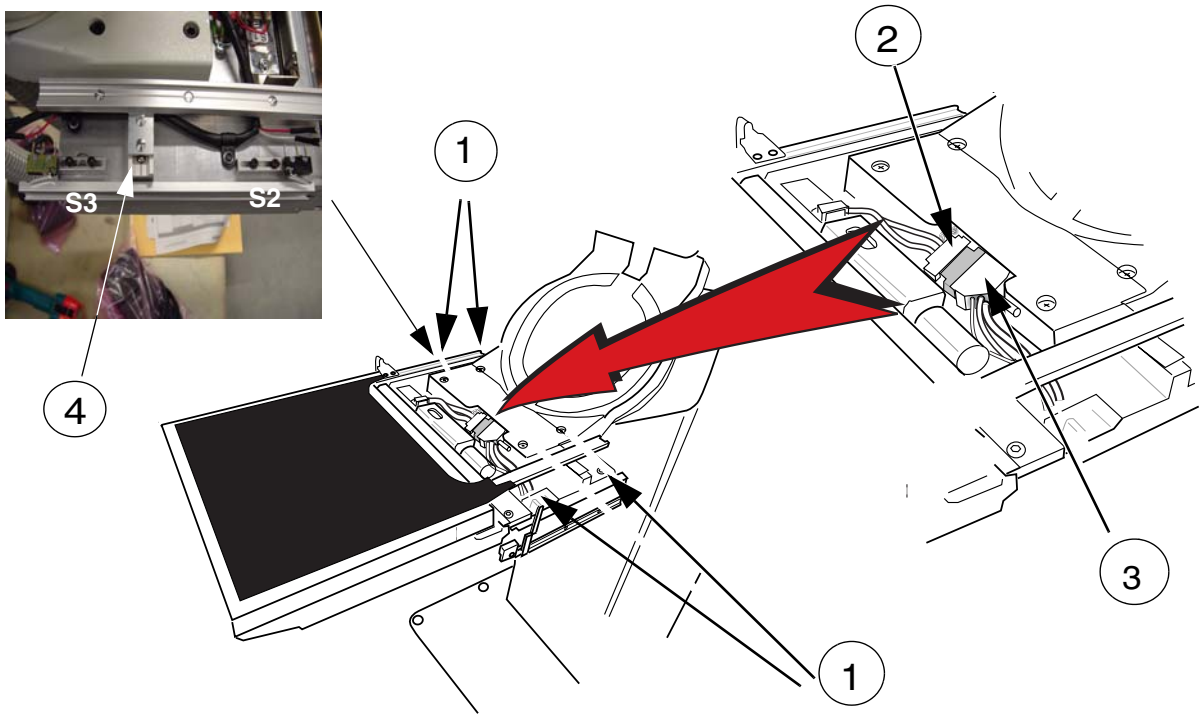


Fig. 6 Detector installation

1. Remove the micro switches and their holders S2 and S3.
2. Remove the cover from the detector cable connector.
3. Loosen the grid holder, 2 screws (4/Fig. 6).
4. Attach the detector with the four bolts (1/Fig. 6). Make sure that the bolts are tightened.

NOTE

To be sure that the detector is correctly mounted and that it is located directly below the radiation field, use the guiding lines on the wing and make sure that the detector is in the right position before screwing the bolts.

5. Insert the detector cable underneath the grid holder and tighten the grid holder screws again (4/Fig. 6).
6. Connect the detector cable (3/Fig. 6) to the cable coming out of the wing (2/Fig. 6).
7. Mount the cover over the detector cable with 2 screws. Make sure that no cables are squeezed.

Mounting the grid

The materials needed for the grid installation can be found in the accessory material box.

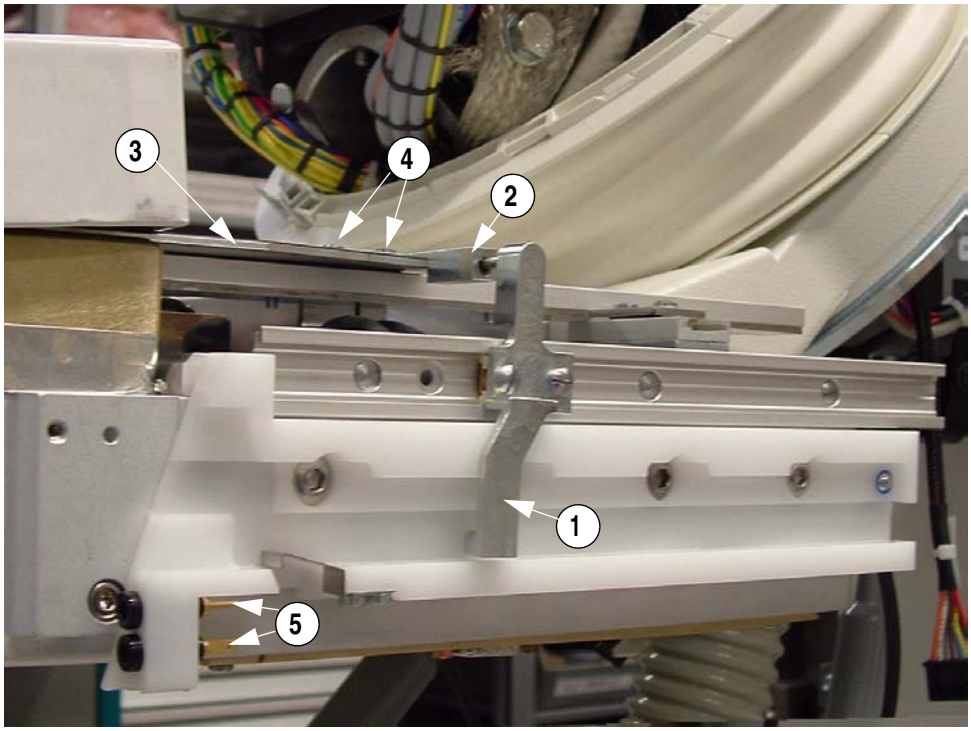


Fig. 7 Grid installation

1. Insert the left and right grid slider (1/Fig. 7) from the back into the rail.
2. Insert the left and right grid holder into the grid slider (2/Fig. 7).
3. Line up the grid to the front of the table, the front switch has to be engaged. Screw the grid (3/Fig. 7) to the grid holder (4/Fig. 7). The marking has to be on top, text must be readable.
4. Connect the cables (5/Fig. 7) for the magnification table, according to the labels, on both sides.

WARNING **Make sure that the cables are connected according to the labels, otherwise the D805 will burn up.**

Adjusting the switches

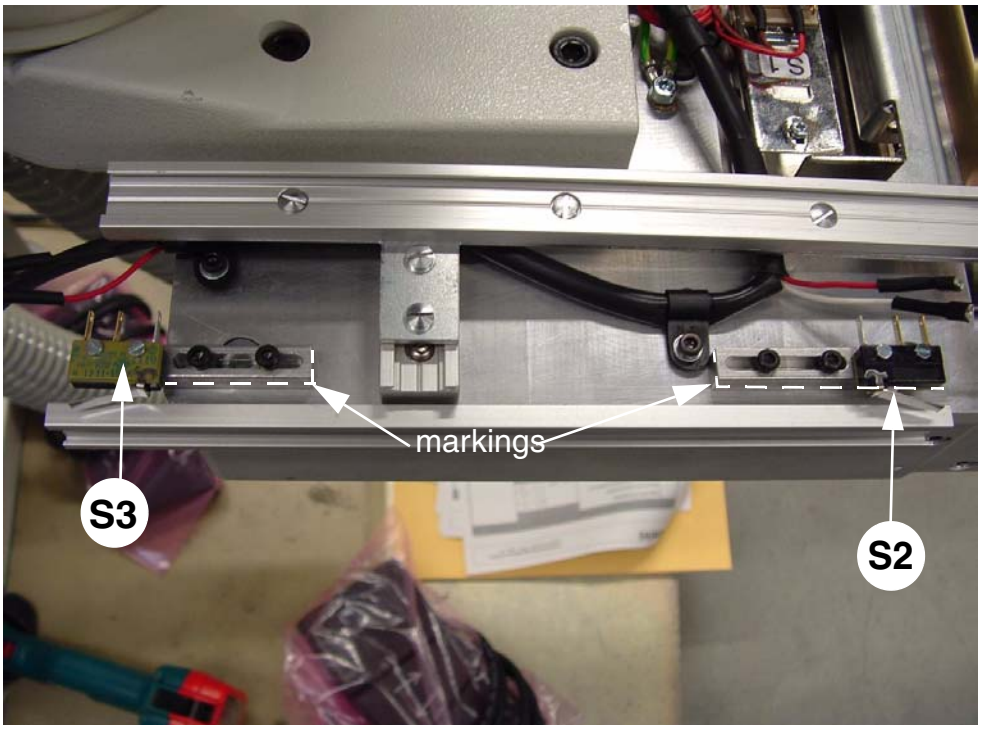


Fig. 8 Micro switch installation

1. Mount the micro switches S2 and S3 (Fig. 8) along the markings.
2. Adjustments of S2
   Move the grid to the front. S2 must switch 2 mm (+1 mm tolerance) before the grid reaches the end position.
3. Adjustment of S3
   Move the grid to the back and insert the magnification table. S3 must switch 2 mm (+1 mm tolerance) before the magnification table reaches the end position.

NOTE

The magnification table is optional. When no magnification is supplied with the system, the micro switch has to be mounted along the markings.
Remember to check the switch adjustment if the customer orders a magnification table.

Mounting the covers

1. Mount the bottom wing cover with 6 screws.
2. Mount the top wing cover with 4 screws.
3. Slide the detector fibre cover carefully over the detector and fasten it with 6 screws at the bottom of the cover.

Mounting covers

Cable duct covers

If not already done, mount the cable duct covers.

Swivel arm covers

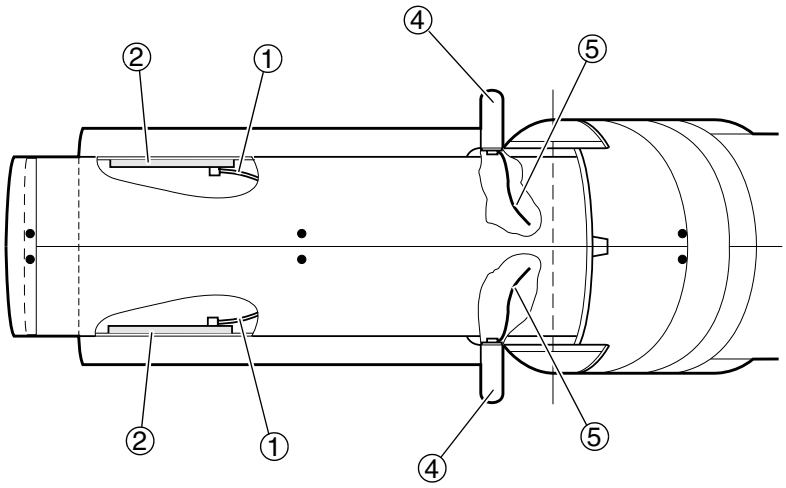


Fig. 1 Connecting the cables

Before installing the side covers, the cables have to be connected.

1. Connect cables X807 (1/Fig. 1) to control button circuit boards D807 (2/Fig. 1).
2. Connect ground wires (3/Fig. 1) to patient handles (4/Fig. 1).

Side covers

Screws in different sizes are included in the delivery.

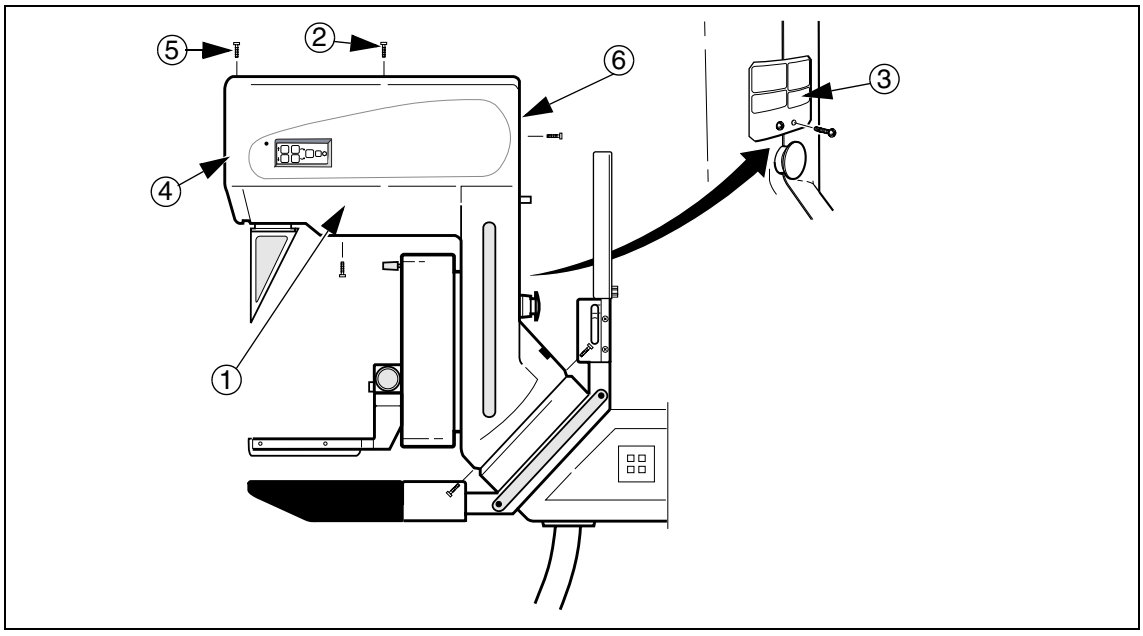


Fig. 2 Covers and sign

1. Mount the side covers (1/Fig. 2) with six screws (2/Fig. 2) on each side. Start with the right side.

NOTE **Do not forget to fit the sign (3/Fig. 2) when mounting the side covers. Use the two longer screws.**

NOTE **Make sure that the longer screws are not used at the back of the covers at the upper location (6/Fig. 2) since this may damage the board underneath the cover.**

Front cover

⚠CAUTION **Risk of damages.**

If the covers are exposed to internal stress, cracks might arise.

The following work must be carried out with caution.

1. The side covers must be flush at the front. If necessary, loosen the screws and adjust the side covers.
2. Carefully fit the front cover (4/Fig. 2) so that both openings engage with the lugs of the side covers.
3. Carefully swing the front cover upwards and let it snap in position over the side covers.

⚠CAUTION **The front cover must not press against the collimator.**

Risk of damage.

Be careful while attaching the front cover.

4. Fasten the front cover to the side covers with two short screws (5/Fig. 2).

Stand covers

⚠WARNING

The edges of the metal curtain of the stand are very sharp.

They may cause severe injury.

Remove the protective strips carefully when the covers are to be mounted. Store the strips in the holders provided on both sides of the curtain.

NOTE

When mounting the stand covers, make sure that the screws at the top of the stand are securely tightened and have functioning contact washers.

These screws are used to establish protective ground connections.

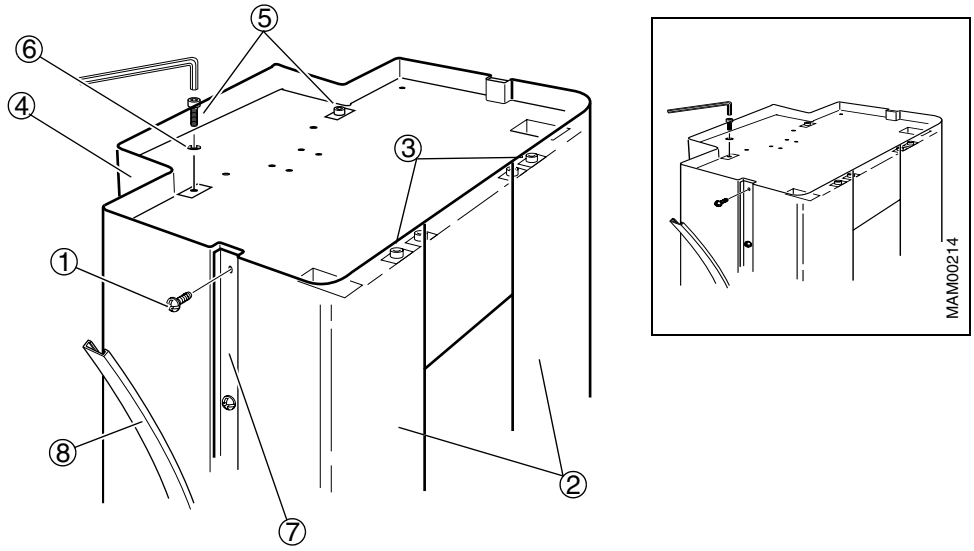


Fig. 3 Mounting the stand covers on a stand with single rear cover.

1. The covers are delivered with a protective plastic film, which shall be removed and discarded.
2. Make sure that clips are positioned over the holes where the screws (1/Fig. 3) are to be fastened. These clips enable the screws to fasten the covers.
3. Fit left and right front covers (2/Fig. 3) to the stand and fasten with screws and contact washers (3/Fig. 3).
4. Fit the rear cover (4/Fig. 3) to the stand and fasten it with screws (5/Fig. 3) and contact washers (6/Fig. 3).

NOTE

Be careful not to damage the cables at the cable outlet!

5. Fit the inner plastic strip (7/Fig. 3) to the front and side covers and fasten with screws (1/Fig. 3), eight on either side.
6. Press on the outer plastic strip (8/Fig. 3).

Stand cap

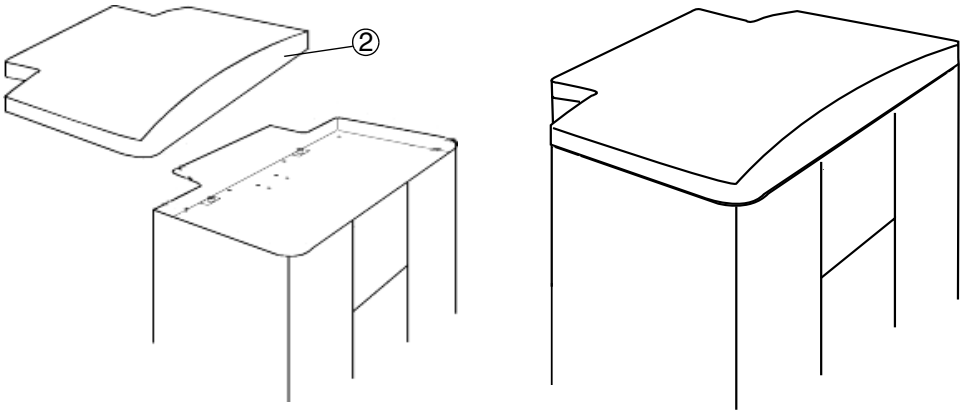


Fig. 4 Stand cap

1. Place the Stand cap on the top of the MAMMOMAT stand (2/Fig. 4).

Face shield

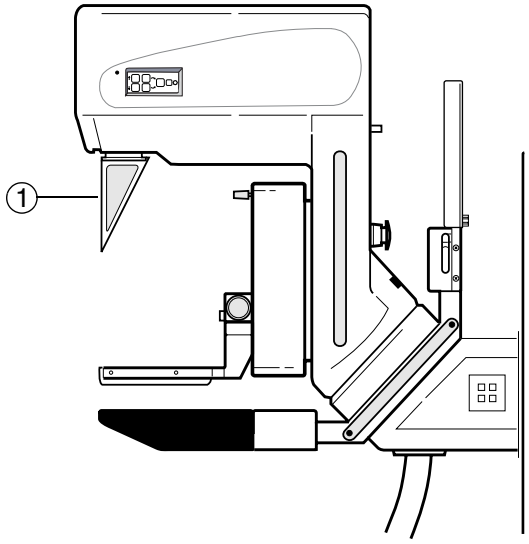


Fig. 5 Face shield

1. Slide the face shield (1) onto the holder for external diaphragms.Checking the swivel arm system

Mechanical Checks

Rotary motion

The rotary motion has to be checked with both wings.

1. System **OFF**.

   The rotary motion and the vertical adjustment of the swivel arm system should be blocked.

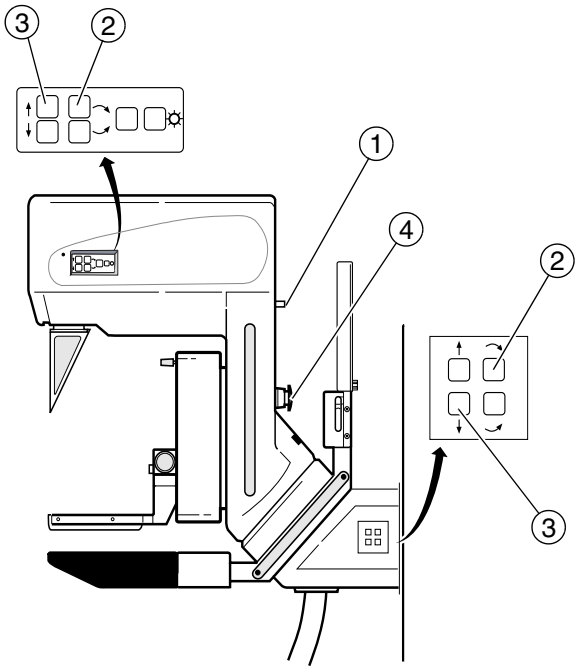


Fig. 6 Swivel arm system

2. Turn the System **ON**.
3. Select the detector wing. **dr** is then displayed on the control console.
4. Set the projection angle set to minimum with presetting knob (No. 1/Fig. 6).
5. Check the rotary motion of the swivel arm system by pressing buttons (2/Fig. 6) one by one.

   The rotation of the swivel arm system shall stop when the button is released or when the end position is reached (**+135 degrees clockwise** and -**180 degrees counterclockwise**). The projection angle is shown on the display at the lower part of the stand.

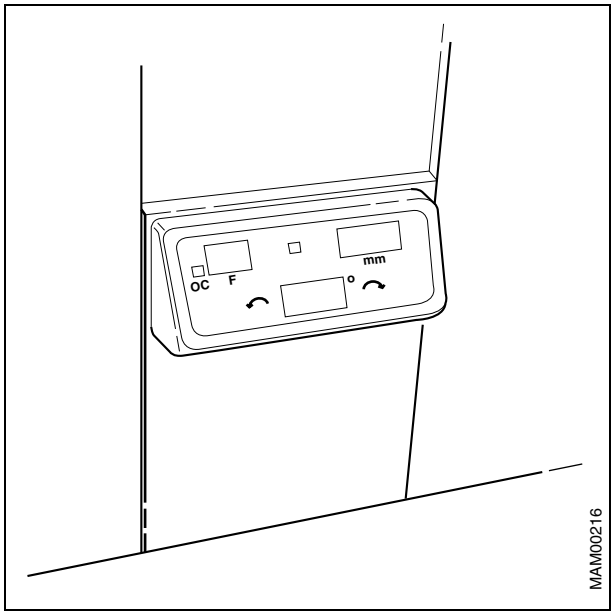


Fig. 7 Display at the lower part of the stand

1. Set the projection angle to **60 degrees** with the presetting knob (1/Fig. 6).

   The preset angle is displayed for approximately **3 s**.

2. Press one of the buttons (2/Fig. 6).

   The rotary motion of the swivel arm system should stop automatically when the preset projection angle (both + and -) is reached and at **0 degrees**., **+90 degrees** or **-90 degrees**.

NOTE

All eight rotary motion buttons (four on either side 2/Fig. 6) must be checked. After the button has been released, the swivel arm system should remain in the position set.

OPDIMA wing

1. Select the **OPDIMA wing**, **OP** is then displayed on the control console
2. Set the projection angle to minimum with presetting knob (No. 1/Fig. 6).
3. Check the rotary motion of the swivel arm system by pressing the buttons (No. 2/ Fig. 6) one by one.

   The rotation of the swivel arm system should stop when the button is released or when the end position is reached (**+120 degrees clockwise** and **-120 degrees counterclockwise**). The projection angle is shown on the display at the lower part of the stand.

Vertical adjustment

⚠CAUTION	**Remove the protective strips before performing the vertical adjustment of the swivel arm.** **If not removed, the protective strips could be damaged.** **Make sure the protective strips are removed before adjustments, see "Metal Curtain" on Page 2 - 2.**

1. Press the buttons for upward and downward movement (3/Fig. 6) of the swivel arm system.

   The movement should stop automatically when either the end position is reached or when the button is released.

NOTE	**All eight vertical adjustment buttons (four on either side 3/Fig. 6) must be checked. The switching off in upper and lower end position is effected by switches S881 and S884 respectively.**

Emergency stop

1. Press the emergency stop button (4/Fig. 6).

   The button should latch and all motorized movements of the equipment shall be blocked ("Er 813" shall appear). To reset the emergency stop button, turn it clockwise.

Disable Film Exposure

The film exposure switch has to be is **disabled**.

1. Connect the Service PC to the MAMMOMAT Stand and start the service software program.
2. Go to

   Configuration -> Miscellaneous -> Allow film exposure

   and make sure that the **Switch** is set to **OFF.**

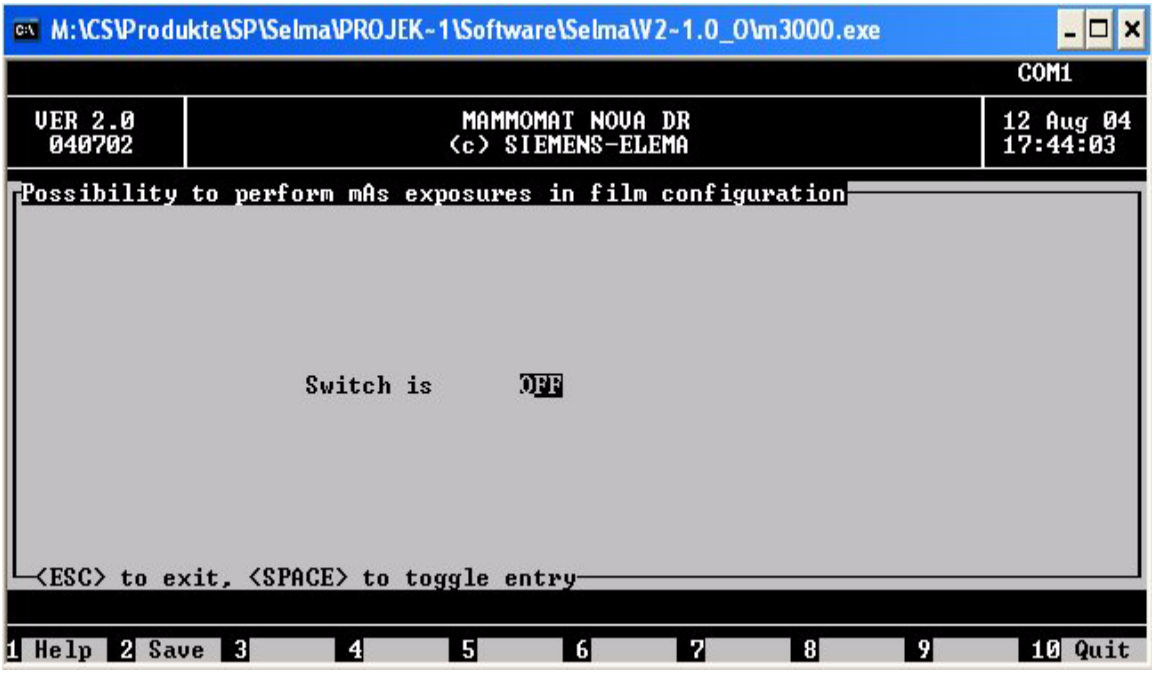


Fig. 8 Set **allow film exposure** to **OFF**

Checking the field light time

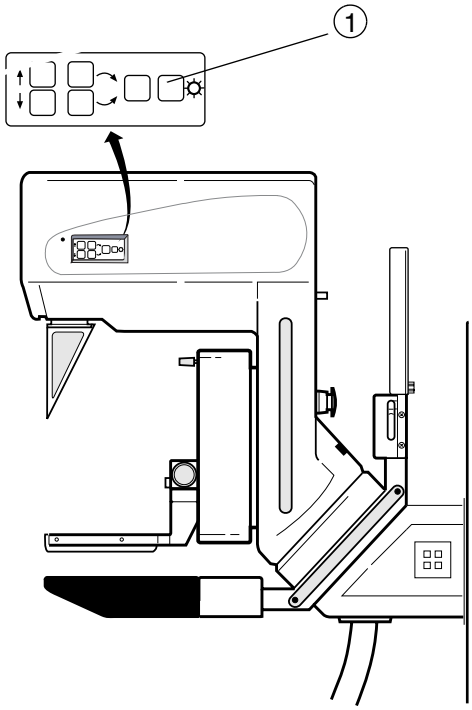


Fig. 9 Field lightswitch

1. Switch on the field light by pressing the switch (1/Fig. 9) or by pressing the compression foot switch (1/Fig. 10).

   The field light shall go out automatically after a preset period of time (normally **20 s**.).

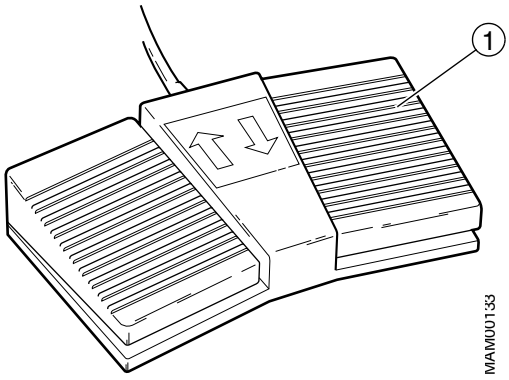


Fig. 10 Foot switch

Adjusting the field light time

The illumination time of the light field can be adjusted within a certain range according to the customer´s requirements.

NOTE	**A shorter illumination time results in an increased life time of the lamp.**

1. Connect the service PC to the D750 and start the MAMMOMAT Service Software.
2. In **Mainmenu** select **Configuration ⇨ Miscellaneous ⇨ Illumination time**.
3. Type in the illumination time and save with <**F2**>.

Checking the compression device

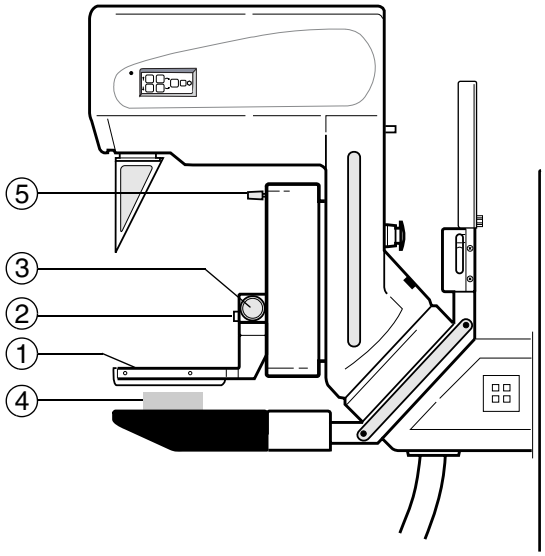


Fig. 11 Swivel arm system

1. Attach the compression plate (1/Fig. 11) if you have not already done so.
2. Check that the compression plate cannot be removed without pressing the compression plate release button (2/Fig. 11).
3. Check the function of the knobs for manual compression/decompression (3/Fig. 11).
4. Place a piece of soft material on the object table, for example a rolled up towel or a piece of foam rubber (4/Fig. 11).

5. Check the function of the foot switch for motorized compression/decompression (1 and 2/Fig. 12).

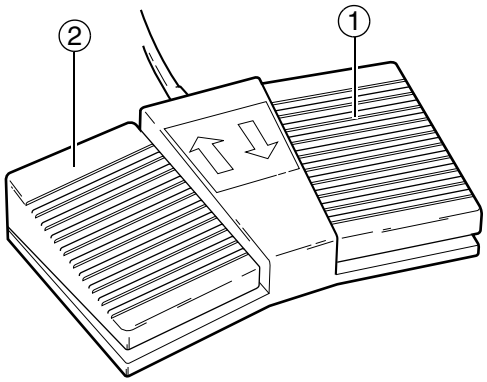


Fig. 12Foot switch

6. Press the foot switch for motorized decompression to move the compression plate upwards while at the same time pressing the compression plate in the opposite direction by hand.

   The upward movement of the compression plate shall now stop (safety switch).

7. Set the compression to **7 kg** by using the presetting knob (5/Fig. 11).

   The preset compression force is shown on the display at the lower part of the stand (1/Fig. 13).

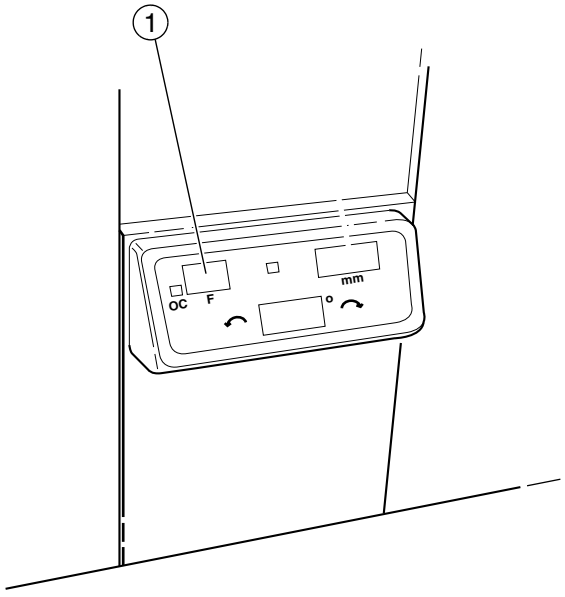


Fig. 13 Display at the lower part of the stand

8. Press the foot switch for motorized compression to move the compression plate downwards while simultaneously pressing the compression plate in the opposite direction by hand.

The compression plate shall now slow down and stop, when the preset compression force is reached.

NOTE	**During compression, the motorized vertical adjustment and the rotary motion of the swivel arm system shall be blocked.**

Decompression button

Check the decompression button on the separate control console for proper function, i.e. that the compression plate moves upwards when the button is pressed.

Checking the OPCOMP

1. Decompress.
2. Set the compression force to **20 kg** by using the presetting knob (5/Fig. 11) and compress.

   The compression movement must be interrupted by OPCOMP before **20 kg** is reached, i.e. at **5-15 kg** depending on the material (4/Fig. 11) used.

Adapting OPCOMP

If the factory-set OPCOMP is not to the customer's satisfaction, an adjustment can be carried out with the tautness factors in the "Optimized compression dr" table, see Service Instructions (**Software, SPB7-250.816.02...**). A lower tautness value will increase the compression force and vice versa.

- Increase/decrease the tautness factor by e.g. **10** the first time. Let the customer use this setting for at least two weeks before further changes are made.

NOTE	**OPCOMP has been thoroughly tested by Siemens. If any factors are changed, OPCOMP will no longer be an optimization of compression force and image quality according to Siemens' clinical test.**

Checking the exposure blocking

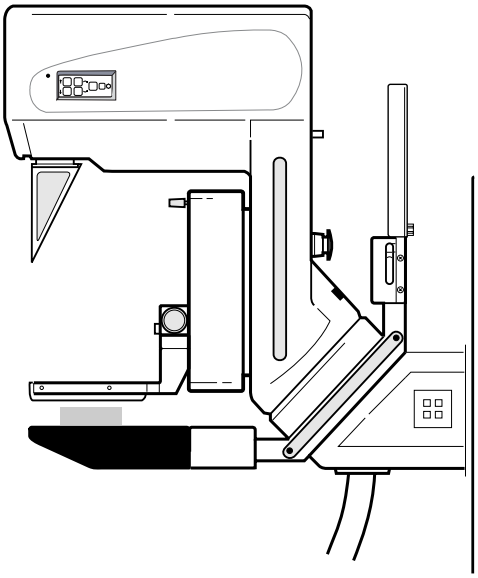


Fig. 14 Swivel arm system

Check that the exposure release is blocked during the following conditions:

- No patient is registered.
- No compression plate is mounted.
- The wing is not in position.

This page intentionally left blank.

Tube high voltage, current and mAs values

This section describes how to check the X-ray tube in regard to the:

- High voltage, tube current, mAs value with and without AEC and with a small or large focus.

Preparation

- Switch the system **OFF**.
- Connect the oscilloscope as follows:

  Channel 1 to measuring point **HV_ACT** **(actual value)** (1 V= 5 kV) on the D750.

  Channel 2 to measuring point **MA_ACT** **(actual value)** (1 V= 40 mA) on the D750.
- Connect the service PC to the stand.
- Start the Service Program and check in the **anode menu** that the tungsten anode is **enabled**.
- Switch the system **ON**.
- Set the "cassette loaded" switch to **OFF** with the Service Program:
  In the **Main menu** choose **Configuration ⇨Miscellaneous ⇨Cassette loaded check**.

Measurement method

- The mAs value must be calculated as the product of the tube current and exposure time. The tube current and the exposure time can be obtained from the oscillograms. The diagram may have glitches, in this case you have to measure the exposure time t_1 and t_2.

Example:

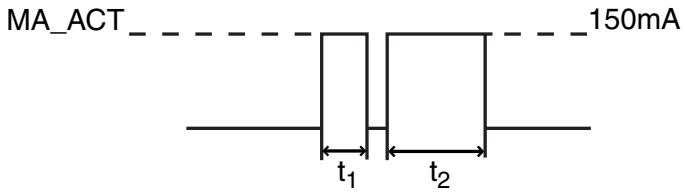


Fig. 1 Check X-ray tube high voltage, current and mAs values

From the figure the tube current is 150mA and the exposure time is t_1+t_2 in seconds. The mAs is $150mA*(t_1+t_2)$.

NOTE

Be aware, that with the AEC mode on, a pre-exposure of 50 ms is done.

Select the correct trigger on the scope, so you get the pre-exposure and the all the exposure times.

Oscilloscope diagram examples

30kV, 20mAs, Mo/Mo

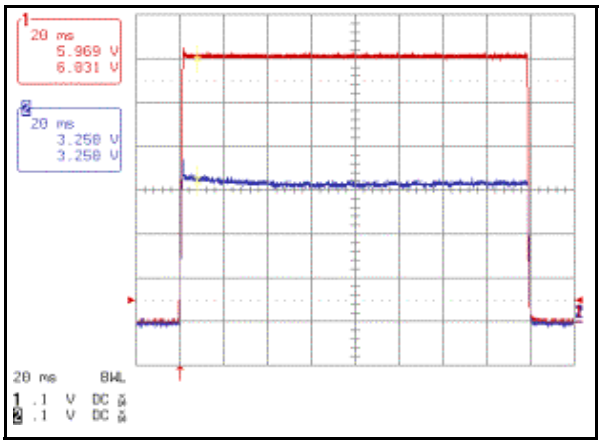


Fig. 2

30kV, 20mAs, W/Rh

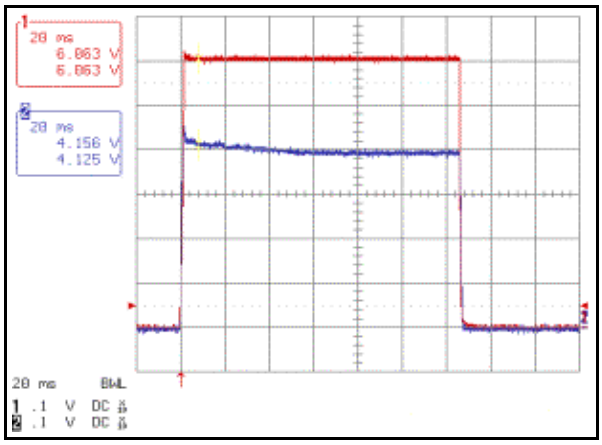


Fig. 3

30 kV	1 V/T (1 T <=> 5 kV)		30 kV	1 V/T (1 T <=> 5 kV)
130 mA	1 V/T (1 T <=> 40 mA)		166 mA	1 V/T (1 T <=> 40 mA)
160 ms	20 ms/T		128 ms	20 ms/T

35kV, 100mAs, Mo/Mo

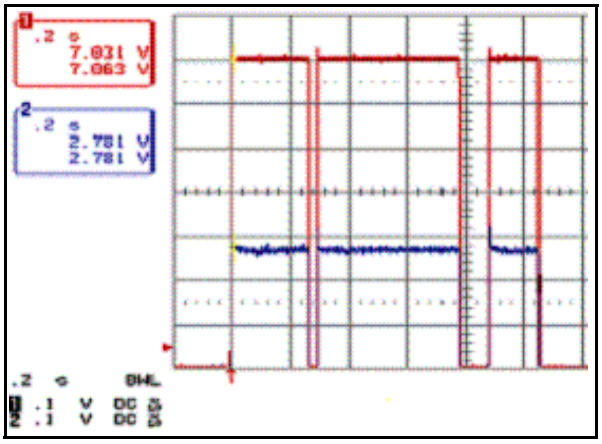


Fig. 4

35kV, 100mAs, W/Rh

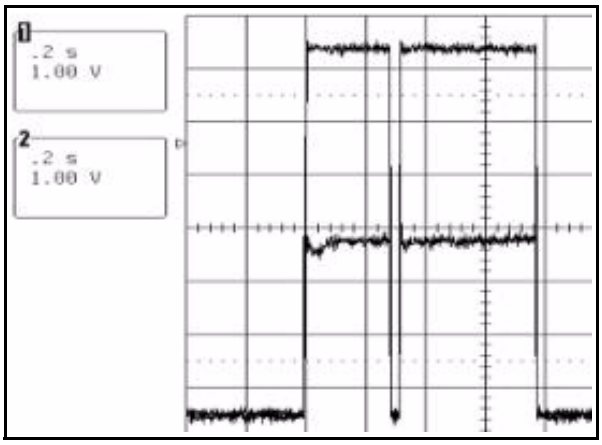


Fig. 5

35 kV	1 V/T (1 T <=> 5 kV)	35 kV	1 V/T (1 T <=> 5 kV)
112 mA	1 V/T (1 T <=> 40 mA)	132 mA	1 V/T (1 T <=> 40 mA)
0.9 s	0.2 s/T	0.72 s	0.2 s/T

Checks with a large focus and without AEC

Prerequisites

- Deselect **D** and **H** on the control console, the MAMMOMAT is in mAs mode without AEC.
- Make sure the magnification table is removed, so that a large focus is selected.
- The check has to be performed for each measurement of the table.

Measurement	kV	mAs	Anode/Filter
1	30	20	Mo/Mo
2	30	20	W/Rh
3	35	100	Mo/Mo
4	35	100	W/Rh
5	25	100	Mo/Mo
6	25	100	W/Rh

Tab. 1 Checks with a large focus and without AEC

- Cover the detector with the large steel plate or with a lead apron.

Test performance

1. Adjust the exposure value on the control console according to the table above.
2. Start an exposure.
3. Check and measure the kV value and the tube current characteristic on the oscilloscope.
   The accuracy of the kV is ±5%, for tube current ±10% and for the mAs product ±10%.
4. Record the measured kV and mAs value in the "**Startup Protocol**" on Page 11 - 1 .
5. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

Checks with a small focus and without AEC

NOTE	**The magnification table is only shipped with the system when the customer had ordered this option.**

Prerequisites

- Make sure the magnification table is mounted, so that a small focus is selected.
- Deselect **D** and **H** on the control console, the MAMMOMAT is in mAs mode without AEC.
- The check has to be performed for each measurement of the table.

Measurement	kV	mAs	Anode/Filter
1	30	10	Mo/Mo
2	30	10	W/Rh

Tab. 2 Checks with a small focus and without AEC

- Cover the detector with the large steel plate or with a lead apron.

Test performance

1. Adjust the exposure value on the control console according to the table above.
2. Start an exposure.
3. Check and measure the kV value and the tube current characteristic on the oscilloscope.
   The accuracy of the kV is ±5%, for tube current ±10% and for the mAs product ±10%.
4. Record the measured kV and mAs value in the "**Startup Protocol**" on Page 11 - 1**.**
5. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

Checks with a large focus and with AEC

NOTE

Be aware, that with the AEC mode on, a pre-exposure of 50 ms is done.

Select the correct trigger on the scope, so you get the pre-exposure and the all the exposure times.

Prerequisites

- Remove the lead apron from the detector.
- Mount the collimator mounted plexi phantom.
- Register a patient.
- Make sure the magnification table is removed, so that a large focus is selected.
- Select **H** on the control console, the MAMMOMAT is in now in AEC mode.
- The check has to be performed for each measurement of the table.

Measurement	kV	mAs	Anode/Filter
1	25	-	Mo/Mo
2	25	-	W/Rh

Tab. 3 Checks with a large focus and with AEC

Test performance

1. Adjust the exposure value on the control console according to the table above.
2. Start an exposure.
3. Check and measure the kV value and the tube current characteristic on the oscilloscope.
   The accuracy of the kV is ±5%, for tube current ±10% and for the mAs product ±10%.
4. Record the measured kV and mAs value in the "**Startup Protocol**" on Page 11 - 1**.**
5. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

This page intentionally left blank.

Automatic collimator

The automatic collimator unit limits the radiation/illumination field on the object table (detector) depending on the combination of the object table, compression paddle and focus.

At startup or reset, a self-test is carried out to check that the collimator lamellae are moving in both directions, from their outer end positions (from now on called the reference position(s)) into and passing the positions for maximum collimation.

After the self-test has passed, collimation is carried out according to the combination of object table and compression paddle. During standby the collimation is always made to the focus of the field light bulb, i.e. to get the illumination field. This field will correspond to the radiation field during the exposure. When the exposure preparation is started, the collimator lamellae are adjusted to the currently selected anode focus, i.e. to get the radiation field.

Exposure will not be allowed as long as collimation is not ready or a not valid object table and compression paddle combination has been selected.

The maximum time to change the size of the field is 7s in standby and 1.9s when the initiation of the exposure preparation has been received. If the maximum time is elapsed, error 816 is generated.

Collimator reference axis

Collimator calibration is used to get the offset values to two reference axes, **y** and **x**.

- The **y-axis** is orthogonal to the chest wall side edge in the center of the object table.
- The **x-axis** is located at the object table chest wall side edge.

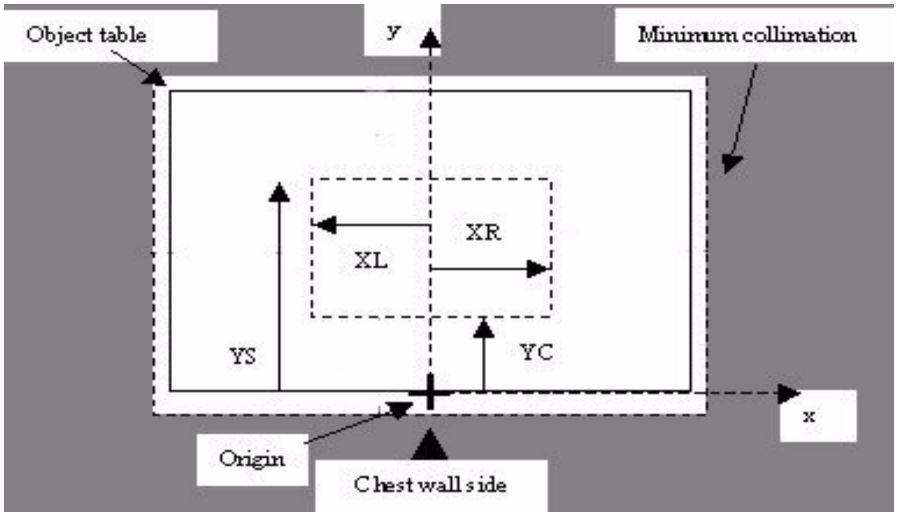


Fig. 1 Collimator calibrations

- Moving the collimator **OUT** is done by **INCREASING** the **YC** value and **DECREASING** the **YS**, **XL** and **XR** values.
- Moving the collimator **IN** is done by **DECREASING** the **YC** value and **INCREASING** the **YS**, **XL**, and **XR** values.

Collimator beam check and calibration

You have to perform the collimator beam check with the **detector wing** for all **focus & anode** combinations.

1. Make sure that a patient is registered.
2. Select the **detector wing**. **dr** is then displayed on the control console.
3. Mount the Collimator Mounted Phantom.
4. Connect the compression simulator.
5. Selecting **25 kV** and **50 mA**s on the control console.

6. Start an exposure.
7. View the image with a magnification of 4.
8. Slide the magnification glass along the image edges of the image and check if white lines are visible.

NOTE

If you do not see white lines at the edges of the image, the collimator beam calibration is correct and you can continue with the "Collimator field light calibration" on Page 7 - 4.

Otherwise continue with the "Collimator beam calibration" on Page 7 - 2

Collimator beam calibration

Collimator for the collimator beam is carried out as follows:

1. Make sure that the **detector wing** is selected. **dr** is then displayed on the control console.
2. Connect the compression plate simulator and the collimator mounted plexi phantom.
3. Connect the service PC to the MAMMOMAT stand and start the service software.

4. Select
   Configuration -> Collimator -> Calibration of beam field

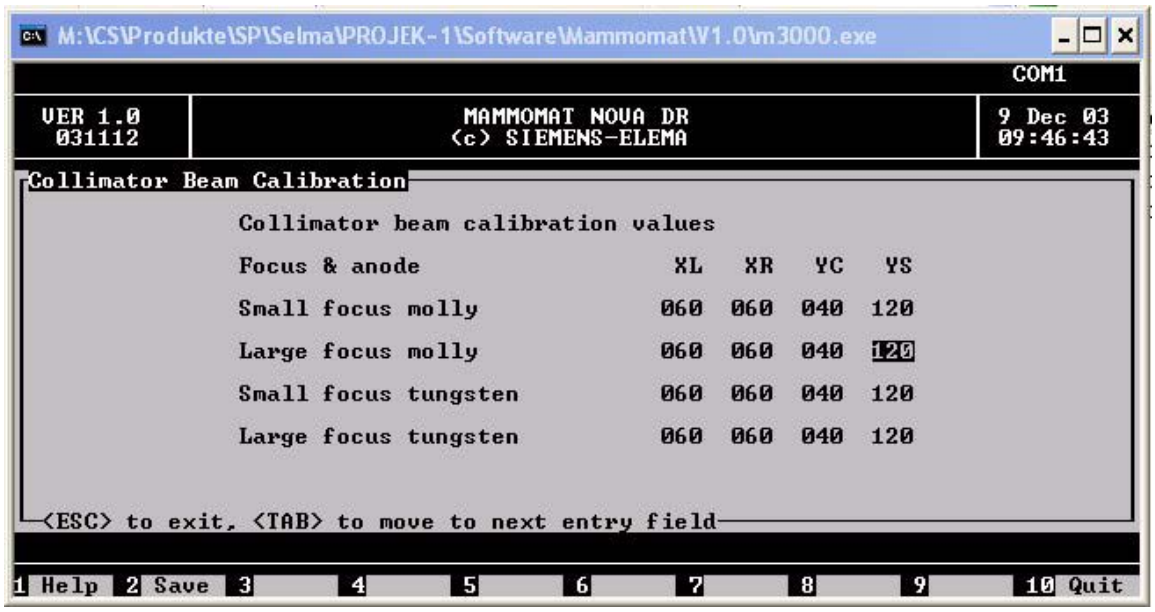

M:\CS\Produkte\SP\Selma\PROJEK-1\Software\Mammomat\V1.0\m3000.exe
COM1
VER 1.0
031112
MAMMOMAT NOVA DR
(c) SIEMENS-ELEMA
9 Dec 03
09:46:43
Collimator Beam Calibration
Collimator beam calibration values
Focus & anode XL XR YC YS
Small focus molly 060 060 040 120
Large focus molly 060 060 040 120
Small focus tungsten 060 060 040 120
Large focus tungsten 060 060 040 120
<ESC> to exit, <TAB> to move to next entry field
1 Help 2 Save 3 4 5 6 7 8 9 10 Quit

Fig. 2 Collimator beam calibration

5. Enter the numbers in the table below so that you always know what settings were used in the beginning:

Focus and Anode	XL	XR	YC	YS
Small focus molly				
Large focus molly				
Small focus tungsten				
Large focus tungsten				

Tab. 1 Collimator beam calibration

6. Narrow the X-ray field so that the edges of the detector will not be exposed with X-ray and white lines are visible in the image at the edges of the detector.

   To do so, decrease the **YC** value and increase the **YS**, **XR** and **XL** values by **5** numbers.

7. Select a **focus & anode** combination.

8. Make sure a patient is registered and start an exposure.
9. Use a magnification of **4** in the application software and go to the edges of the detector. White areas should be visible at all edges of the image. This shows you that the X-ray does not cover the entire detector and shows where the beam really ends.
10. Measure the white line thickness at each image edge with the application GUI and adjust the corresponding **XL**, **XR**, **YC** and **YS** values with the service software

11. Start an exposure.
12. Check if the while lines at the edges of the image are gone, using a magnification of **4** in the application graphical user interface.
13. Repeat the procedure for **all focus & anode** combinations until all white lines at the image edges are gone.
14. **Save** the calibration and **Exit** from the service software.

NOTE

If you see a white thin line on the chest wall when using the magnification table, it might be the magnification table itself. Pull the magnification table out by approximately 1 mm and try again.

15. Record the measured values in the "**Startup Protocol**" on Page 11 - 1 **.**

Collimator field light calibration

Calibration for the field light is carried out as follows:

1. Select the **detector wing**. **dr** is then displayed on the control console.
2. Start the service software on the service PC and select:

   Configuration -> Collimator -> Calibration of light field

Fig. 3 Collimator light calibration

3. Position the X-ray cross in the center of the detector.
4. Make sure that a patient is registered.
5. Mount the Collimator Mounted Phantom.
6. Mount the compression simulator.

7. Deselect **H** and **D** on the control console by selecting **25 kV** and **50 mAs** on the control console.
8. Start an exposure.
9. Compare the image with the reading of the X-ray cross on the detector when the light field is turned on.
10. Adjust the difference with the service software.
11. Continue with Step 7 until the beam field and light field are identical.
12. **Save** the calibration and **Exit** the service software.
13. Record the measured values in the **"Startup Protocol**" on Page 11 - 1 **.**

Collimator Wing Difference Calibration

The collimator wing difference calibration has to be adjusted.

NOTE

If no precise wing difference calculation is performed, or if you have to start from scratch, you can start with the "large focus/ molly" values that have been adjusted with the "Collimator beam calibration" on Page 7 - 2.

1. Select the **OPDIMA wing** by moving the detector in the parking position. **OP** is then displayed on the control console.
2. Connect the compression plate simulator and the collimator-mounted plexi phantom.
3. Start the service software on the service PC and select:

   Configuration -> Collimator -> Calibration of wing difference

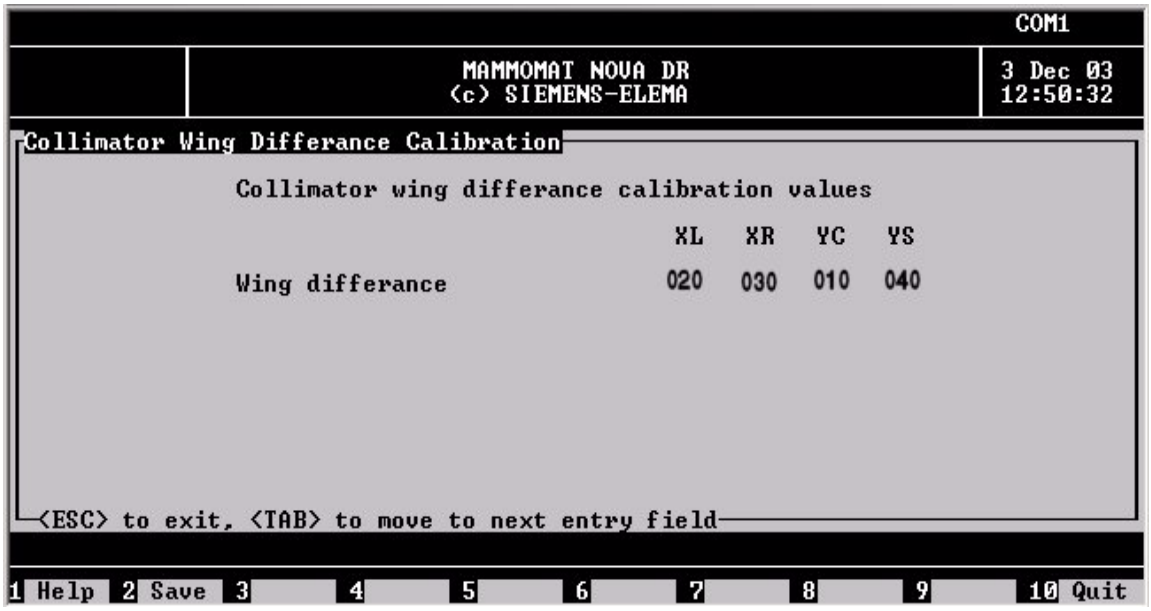

COM1
MAMMOMAT NOVA DR
(c) SIEMENS-ELEMA
3 Dec 03
12:50:32
Collimator Wing Differance Calibration
Collimator wing differance calibration values
XL XR YC YS
Wing differance 020 030 010 040
<ESC> to exit, <TAB> to move to next entry field
1 Help 2 Save 3 4 5 6 7 8 9 10 Quit

Fig. 4 Collimator wing difference calibration

4. Enter the numbers in the table below:

Focus and Anode	XL	XR	YC	YS
Wing difference				

Tab. 2 Wing difference

5. Narrow the X-ray field so that the edges of the detector will not be exposed to the X-ray and white lines are visible in the image at the edges of the detector.
To do this, decrease the **YC** value and increase the **YS**, **XR** and **XL** values by **5** numbers.

6. Make sure a patient is registered and start an exposure.
7. Use a magnification of **4** in the application software and go to the edges of the detector. White areas should be visible at all edges of the image. This shows you that the X-ray does not cover the entire detector and shows where the beam really ends.
8. Measure the white line thickness at each image edge with the application graphical user interface and adjust the corresponding **XL**, **XR**, **YC** and **YS** values with the service software.

9. Start an exposure.
10. Check if the white lines at the edges of the image are gone using a magnification of **4** in the application graphical user interface.
11. **Save** the calibration and **Exit** from the Service Software.

NOTE

If you see a white thin line on the chest wall when using the magnification table, it might be the magnification table itself.
Move the magnification table out by approximately 1 mm and try again.

12. Record the measured values in the **"Startup Protocol**" on Page 11 - 1 **.**

Enable/Disable Dose Calculation

If desired, the Dose Calculation System can be enabled/disabled. As a default the Dose Calculation System is **enabled**.

This is done by starting the Dose Calculation Program in the service PC.

From the **Mainmenu** in the Service program choose:

Configuration ⇨ Dose Calculation ⇨ Enable/Disable Dose Calculation.

To show the calculated dose values on the control console, **enable** this option (ON).

The dose will be shown in the mAs/mGy display (Fig. 1), the value shown will shift from mAs to dose with approximately 2 second intervals.

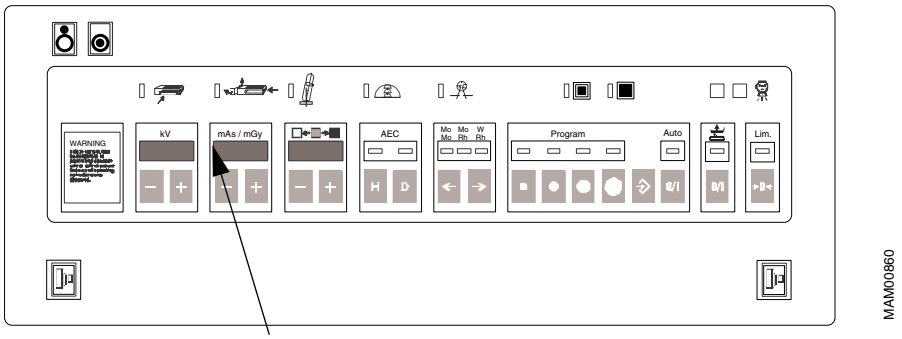


Fig. 1 mAs / mGy value

NOTE	**Selecting "OFF" will only prevent dose values from showing in the mAs/mGy display. Dose calculations will still be performed, and can be printed out if the printer option is installed.**

Configuring of Dose Calculation System

The Dose Calculation System comes with factory default values. Normally, the factory default values should be used. If desired, measurements of HVL (Half Value Layer) and Dose Exchange factors can be performed to improve the accuracy of displayed dose values. These measurements should be performed by the hospital's medical physicist, and are described in the document "**Radiographic Handbook, Dose Calculation System, SPB7-230.206.01...**". The measuring procedure is quite complicated and should only be performed by a physicist familiar to similar measurements. If the HVL and Dose Exchange values are to be measured, the document "**Software, SPB7-250.816.01...**" describes how to enter the values in the Dose Calculation Program.

If reinstalling factory default parameters, all previously entered measured data (HVL values and Dose exchange factors) will be lost. However, the measured data should already be noted in the document "**Radiographic Handbook**".

Label

If the Dose Calculation System is enabled, affix a mAs / mGy label over the "**mAs**" text on the control and display panel. The label is found in register 3 of the Technical Manual binder.

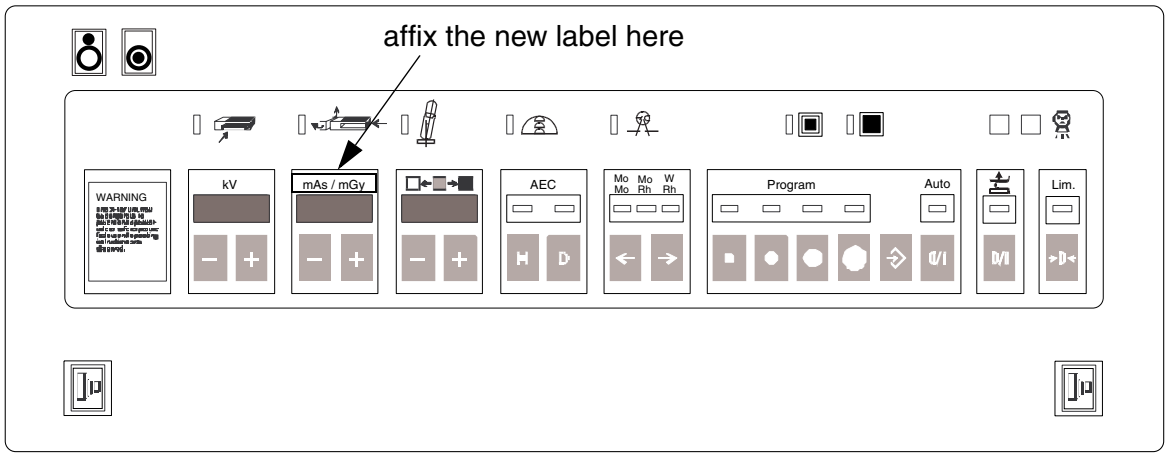


Fig. 2

Checking OPDOSE

The OPDOSE values are checked in this chapter.

In AUTO mode the system suggests an appropriate program (kV, Anode/Filter combination) corresponding to a specific breast thickness. The new, suggested program is indicated by a blinking LED, whereas the previously used program is shown by a continuously lighted LED.

Please, see the **Instructions of Use** (SPB7-250.620.01...) for the correct OPDOSE values.

Changes can be made with the MAMMOMAT stand service software:

Configuration -> Miscellaneous-> Auto limits.

A special setting can be stored for each wing, thus the measurement has to be performed for the **detector wing** and the **OPDIMA wing**.

Proceed as follows for the "detector wing":

1. Select the **detector wing**. **dr** is then displayed on the control console.
2. Mount a 18x24 cm compression plate.
3. Select a thickness of calibration plexi (part no. 65 61 240) that is within the thickness interval of the program to be tested.
4. Select **AUTO** on the control panel.
5. Place the calibration plexi on the object table and compress to 6 kg or more.
6. Check that the correct program is blinking on the control panel. Select the program by pressing the corresponding program button on the control panel.
7. Repeat the procedure described in **steps 3-6** for the other programs used.
8. Record the measured values in the **Installation Protocol** (SPB7-250.813.01)... .

Proceed as follows for the "OPDIMA wing":

1. Select the **OPDIMA wing**. As a result **OP** is displayed on the control console.
2. Mount the **spot 1.0** compression plate.
3. Select a thickness of calibration plexi (part no. 65 61 240) that is within the thickness interval of the program to be tested.
4. Select **AUTO** on the control panel.
5. Place the calibration plexi on the object table and compress to 6 kg or more.
6. Check that the correct program is blinking on the control panel. Select the program by pressing the corresponding program button on the control panel.
7. Repeat the procedure described in **steps 3-6** for the other programs used.
8. Record the measured values in the "Startup Protocol" on Page 11 - 1 .

Checking the AEC dose settings

The dose values for the AEC settings (**H** & **D** selection on the control console) have to be checked.

As a default from the factory, the following **BRICK / AEC Configuration** (for further details see the **Software Brick V...** manual SPB7-250.816.04...) values are set:

- **H = (80, 70, 45)**
- **D = (100, 80, 60)**

Checking the H & D dose settings for Mo/Mo.

Proceed as follows:

1. Mount the Collimator Mounted Plexi phantom and the compression plate simulator.
2. Register or create a patient and submit with **Exam**.

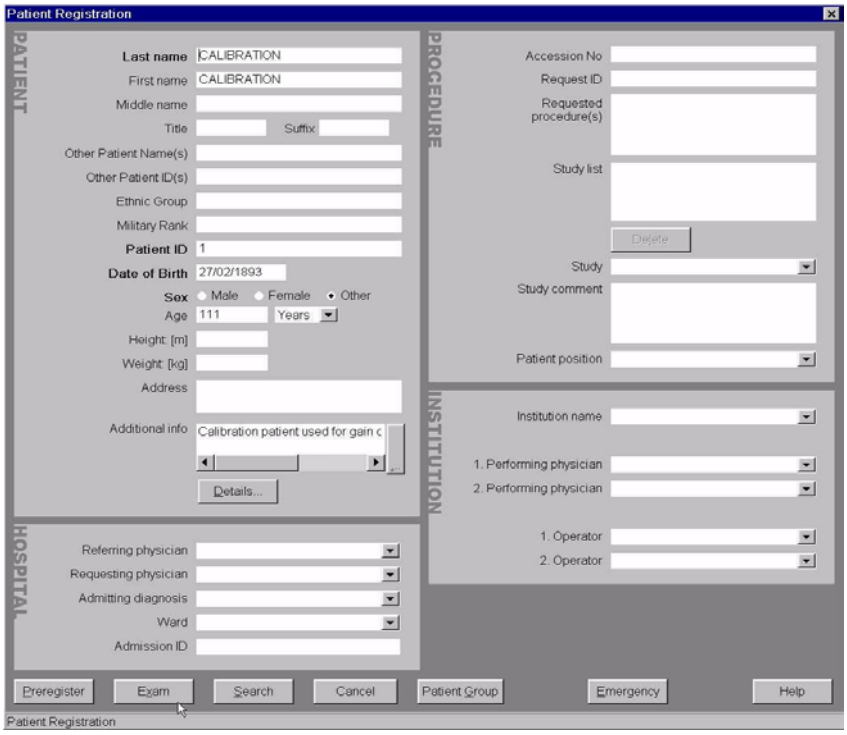


Fig. 3 Calibration - Patient register

3. Select the Procedure **Calibration** from the examination tab card.

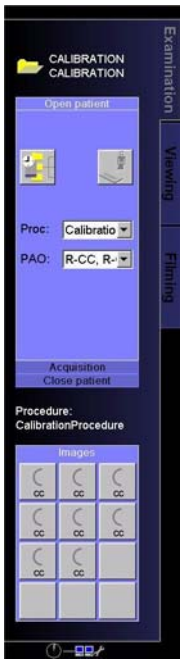


Fig. 4 Select procedure for dose measurement

NOTE	**Remember, you can always add or remove images to the "Procedure" by using the right mouse click.**

4. Select the appropriate exposure parameters according to the table.

AEC	kV	Anode / Filter	Dose Value	Pixel Value
H	28 kV	Mo/Mo		
D	28 kV	Mo/Mo		

Tab. 1 Checking H & D dose settings for Mo/Mo

5. Position the dose meter probe 6 cm from the chest wall and 3 cm off the center of the detector.

NOTE	**If parts of the meter probe covers the AEC sensor one will get a higher dose.** **Thus, make sure that the probe is not covering the AEC sensors. One can check this with the mounted compression plate. The AEC sensors are drawn on the compression plate.**

6. Start an exposure.
7. Measure the following values and add them to the table at step 4:

- **dose value** in the table above. The measured AEC dose values shall be between:

H -> 120 µGy to 140 µGy

D -> 180 µGy to 200 µGy

- image **pixel mean value**
Display the image with the ***syngo* Image Viewer**. To do so click on the **Viewing** tabcard, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**. Draw an area of approximately **1 sq.cm** and measure the pixel mean value. You have to measure approximately **2 cm** above the chest wall at the center of the detector.
Criteria: The expected pixel mean values are:

H = 250 350

D = 300 400

8. If the **H & D** dose settings have to be adjusted, proceed with Chapter 8 "Adjust the H and D Settings" and repeat the H & D dose check for Mo/Mo again.

9. Record the measured values in the "**Startup Protocol**" on Page 11 - 1 **.**

Check the H & D dose settings for Mo/Rh and W/Rh.

If the Mo/Mo AEC does values for **H & D** are within the specification, proceed as follows:

1. Mount the Collimator Mounted Plexi Phantom.

2. Select the appropriate exposure parameters according to the table and start an exposure.
3. Select the anode/filter combination according to the table and set the mAs (control console) as close as possible to the H & D mAs values (Mo/Mo) that you have measured in step 2.

   Display the image with the ***syngo*** **Image Viewer**. To do so click on the **Viewing** tabcard, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**. Draw an area of approximately **1 sq.cm** and measure the pixel mean value.

   Add the result to the table.

Anode / Filter	AEC	kV	Pixel value
Mo/Rh	H	28 kV	
	D	28 kV	
W/Rh	H	28 kV	
	D	28 kV	

Tab. 2 Checking the H & D dose settings for Mo/Rh and W/Rh

   The Mo/Rh and W/Rh pixel values must be as close as possible to the Mo/Mo pixel values (see table at step 2).

   The deviation must not exceed +/- 20 %.

4. If the **H & D** dose settings have to be adjusted, proceed with Chapter 8 "Adjust the H and D Settings" and repeat the **H & D** dose checks for Mo/Rh and W/Rh again.

5. Record the measured values in the **"Startup Protocol**" on Page 11 - 1 **.**

Adjust the H and D Settings

To adjust the

H value, go to **Modify low dose scaling** (80, 70, 45) and

D value, go to **Modify high dose scaling** (100, 80, 60) and

enter the new values, separated by a comma, e.g. **100,80,60**. The values represent the factor in % for (Mo/Mo, Mo/Rh, W/Rh**).**

Three settings **try** (short-term, is valid for one measurement only), **save** (long-term, valid also after reboot) and **load** (effective, valid until the system is rebooted) can be used in the drop-down menu above the values.

To change the values permanently, enter the correct values and select **save**, then use **load** to load them before you start another exposure.

Calculation of the new Mo/Mo dose scaling value:

$$NewScalingValue = OldScalingValue * DoseValue_{Nominal} / DoseValue_{Measured}$$

$DoseValue_{Nominal}$ for H = 130 µGy

$DoseValue_{Nominal}$ for D = 190 µGy

Calculation of the new Mo/Rh, W/Rh dose scaling values:

$$NewScalingValue = OldScalingValue * PixelValue_{Mo/Mo} / PixelValue_{Measured}$$

Proceed as follows:

1. Go into the service software and select **Utilities -> Escape to OS** and enter the following command in the **Command** field.

   start explorer http://brick

2. Select **Brick -> AEC Configuration.**

3. The BRICK software switches to a higher user level, thus a Username and Password have to be entered.

   Username: **root**

   Password: **********

4. Click **Modify settings.**

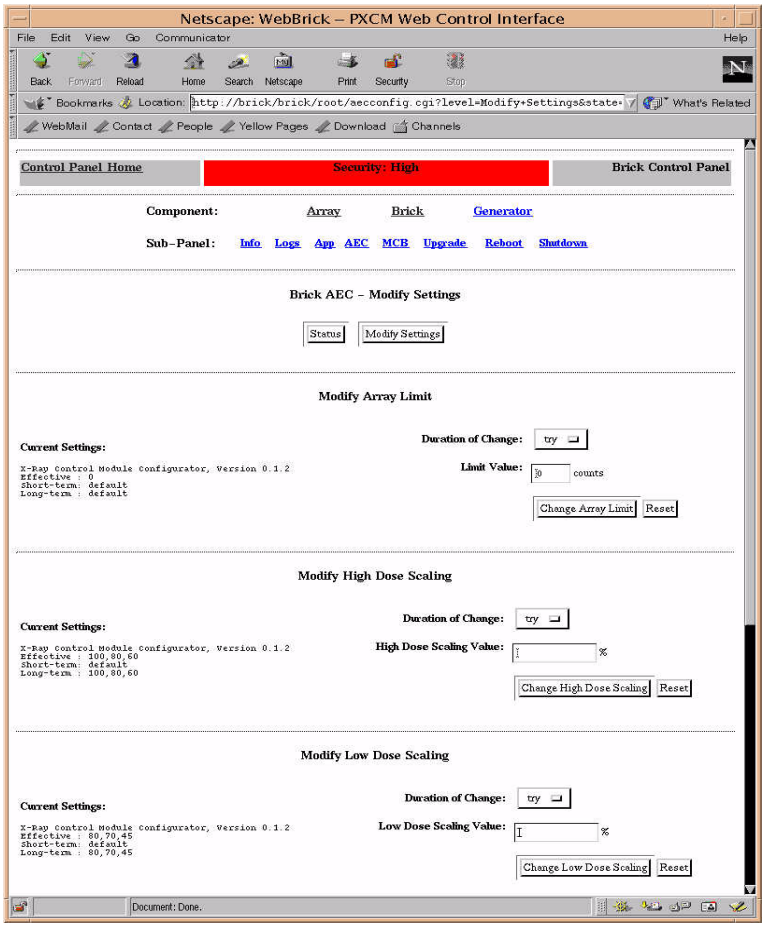


Fig. 5 BRICK - Modify settings

5. To adjust the

   - H value,
   go to **Modify low dose scaling** (The default values are 80, 70, 45) and enter the new values, separated by a comma, e.g. **80,70,45** in the **Low Dose Scaling Value** field and click **Change Low Dose Scaling** to save it.

   - D value,
   go to **Modify high dose scaling** (The default values are 100, 80, 60) and enter the new values, separated by a comma, e.g. **100,80,60** in the **High Dose Scaling Value** field and click **Change High Dose Scaling** to save it.

6. Proceed from where you have been referenced from.

This page intentionally left blank.

Checking Grid Lines

This chapter contains .

- "Checking visibility of grid lines" on Page 9 - 1
- "Measuring grid lines" on Page 9 - 3
  If grid lines are visible in one or more images the grade of grid lines must be measured. The criteria for the **mean pixel value difference** of the visible grid lines is less then 1%.
- "Eliminating Grid lines" on Page 9 - 4

Pre Conditions

- The system is up and running.
- The operator is logged in to the system.
- The compression plate simulator is mounted on the MAMMOMAT.

Checking visibility of grid lines

1. Register or create a patient "**Grid lines test**" and submit with **Exam**.

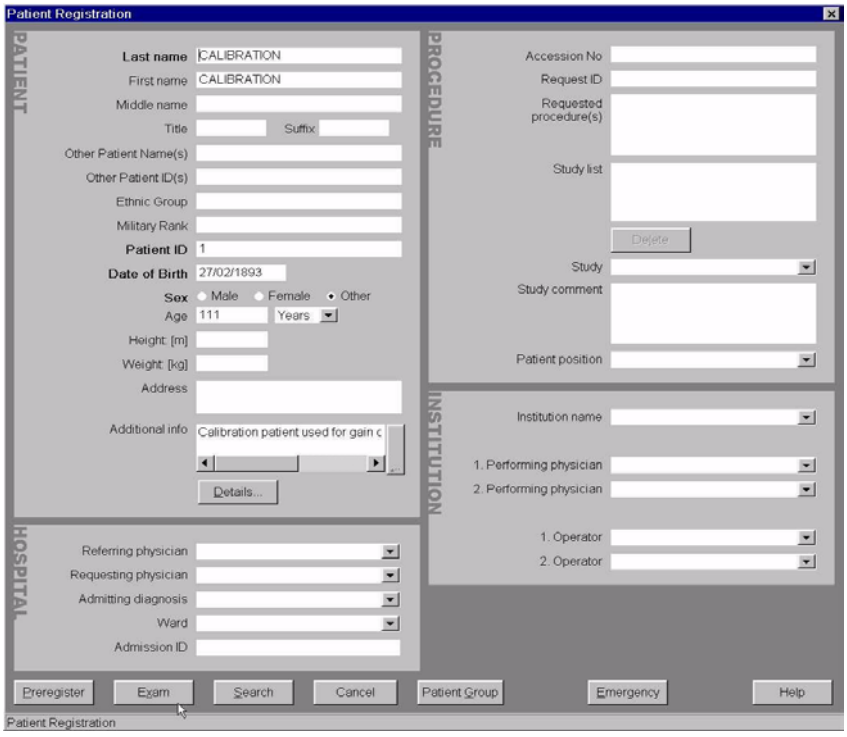


Fig. 1 Calibration - Patient register

2. Select the Procedure **User 1** from the examination tab card.

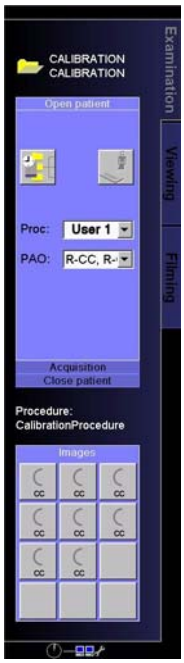


Fig. 2 Select Procedure for grid line test

NOTE	**Remember, you can always add or remove images to the "Procedure" by using the right mouse click.**

3. Select the exposure parameters: **28 kV** and **Mo/Mo.**
4. Make sure that a 1:1 view is selected**,** to have a better view.

   Select **Image -> Change Layout -> a 1:1**

5. Do all exposures according Tab. 1.
6. Activate magnification **(Image -> Magnify by 2.0)** and look for grid lines over the plexi phantom area.
7. Note the result (visible grid lines) in Tab. 1, choose the next image in the list and start over with step 5 until all images are evaluated.

Test 1 Protocol

Exposure	Exp Mode	mAs	PMMA / mm	Tube Angle	Visible grid lines (yes/no)
1	mAs	32	30	0^o	
2	mAs	56	40	0^o	
3	mAs	110	50	0^o	
4	AEC "H"	-	40	0^o	
5	AEC "H"	-	40	$+ 60^o$	
6	AEC "H"	-	40	$- 60^o$	

Tab. 1 Checking visibility of grid lines

Test Criteria

The test will pass if **no** grid lines are visible in all images.

If grid lines are visible

- continue with "Measuring grid lines" on Page 9 - 3 on the image(s) that didn't pass.

Otherwise

- Record the measured value in the **"Startup Protocol**" on Page 11 - 1 and
- continue with "Checking Image Quality" on Page 9 - 8.

Measuring grid lines

1. Load the image in the ***syngo* Image Viewer** and select the first image where visible grid lines were detected (see Tab. 1).
   To do so click on the **Viewing** tabcard, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**. Draw an area of approximately **1 sq.cm** and measure the pixel mean value. You have to measure approximately **2 cm** above the chest wall at the center of the detector.
2. Activate magnification **(Image -> Magnify by 2.0)**.
3. Select **Tools -> Rectangle** and draw a rectangle on the "background" according to Fig. 3 **(X)**. The rectangle should be approximately **5 cm** long.

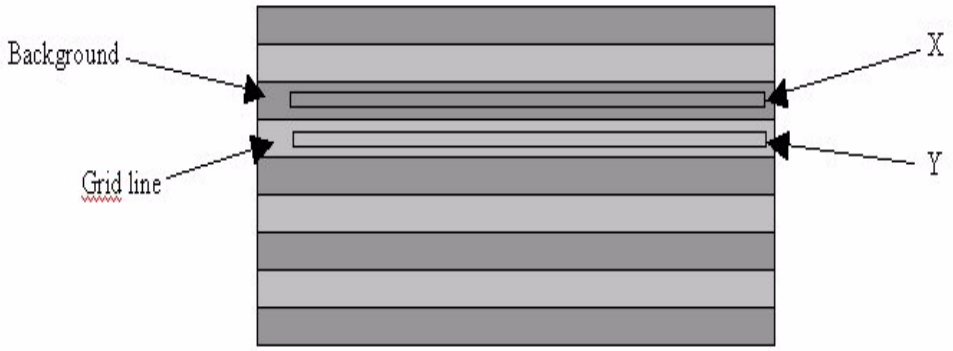


Fig. 3 Measure Grid Lines

4. Make a new rectangle on a **"grid line"** according to Fig. 3 **(Y)**. The rectangle should be approximately **5 cm** long.
5. Note the **Mean Value** result in column **Y** in Tab. 2.
6. The mean pixel value difference shall be calculated as **(X-Y)/X** where **Y** is the mean value in the grid line and **X** is the mean value in the background as seen in Tab. 2.
   Note the result in the Tab. 2.
7. Choose the next image that had visible grid lines in the list and start over with step 3 until all images are evaluated.

Test Protocol

Expo-sure	Exp Mode	mAs	PMMA / mm	Tube Angle	visible grid lines (yes/no)	X	Y	Mean pixel value differ-ence [%]
1	mAs	32	30	0^o				
2	mAs	56	40	0^o				
3	mAs	200	60	0^o				
4	AEC "H"	-	40	0^o				
5	AEC "H"	-	40	$+ 60^o$				
6	AEC "H"	-	40	$- 60^o$				

Tab. 2 Measuring Grid Lines

Test Criteria

If the **mean pixel value difference** is less than 1%, for the images with visible grid lines, the test has passed.

If the "mean pixel value difference" does not meet the criteria,

- continue with "Eliminating Grid lines" on Page 9 - 4 .

Otherwise

- Record the measured value in the **"Startup Protocol**" on Page 11 - 1 and
- continue with "Checking Image Quality" on Page 9 - 8.

Eliminating Grid lines

There are various adjustments for eliminating grid line problems:

- Adjust the grid switch
- Adjust the "wheel" that is mounted on the grid motor
- Adjust the grid location

Adjust the grid switch

The switch S1, see Fig. 4, on the detector table disables the high voltage when the grid is in the turning point. The switch must be correct adjusted otherwise the high voltage will be active when the grid is standing still.

To minimize the risk that the high voltages is active then the grid is standing still the "time" the high voltage is disabled should be as long as possible.

1. Move the grid to the left end position.

2. Loosen the three screws. Now it's possible to adjust the grid switch (S1) alongside the grid (see Fig. 4).

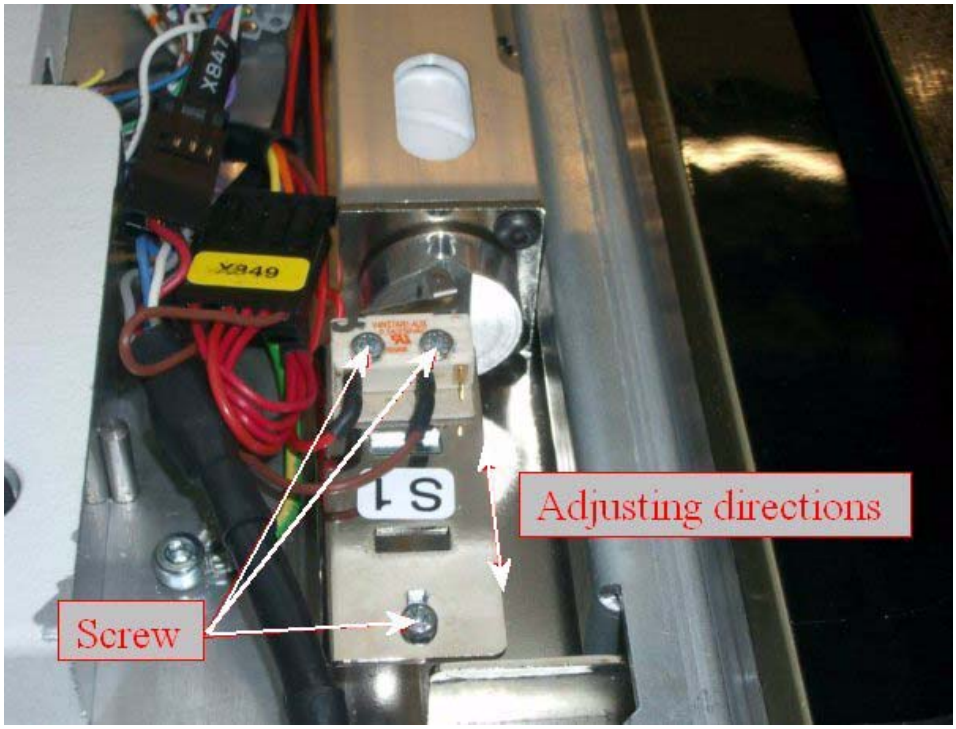


Fig. 4 Adjust grid switch S1

3. Adjust the grid switch so it will active and deactivate on either edges of the slits (see Fig. 5 and Fig. 6). You'll hear a "click" when the switch activates or deactivates.

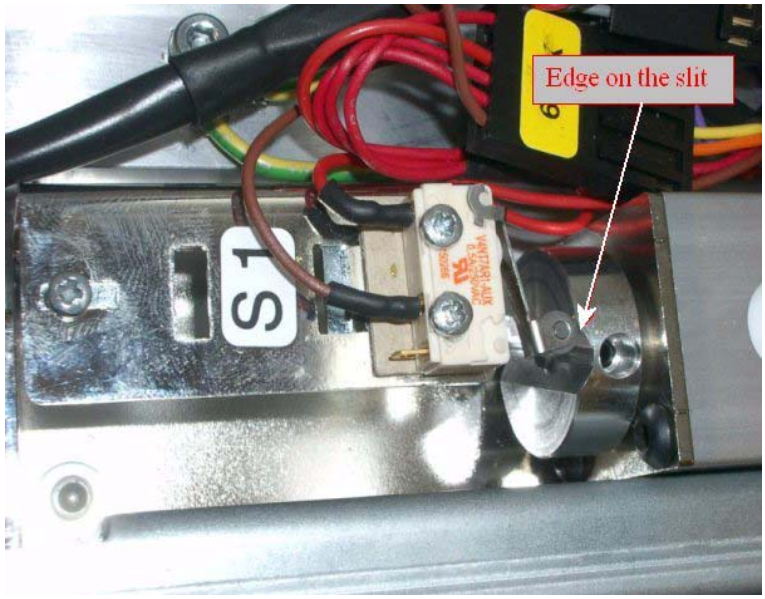


Fig. 5 Adjust grid switch on edge 1

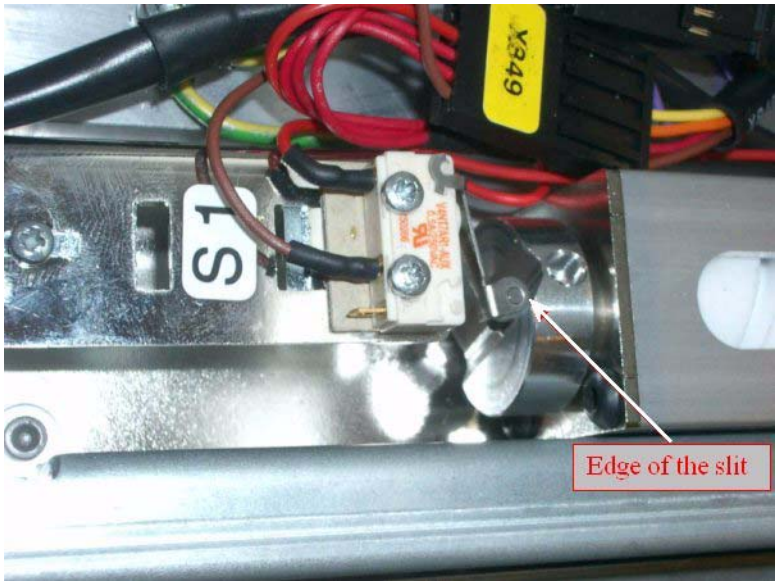


Fig. 6 Adjust grid switch on edge 2

4. Fasten the three screws.
5. Move the grid to the other end position and check that the grid switch activates/ deactivates on either edge of the slit (see Fig. 6 and Fig. 5).

Adjust the "wheel" that is mounted on the grid motor

A wheel is mounted on the left side of the grid motor (M1), on the wheel there is a slits which activates the grid switch (S1).

1. Move the grid to the left end position.

2. Check if the slits are horizontal to the detector table (see Fig. 7).

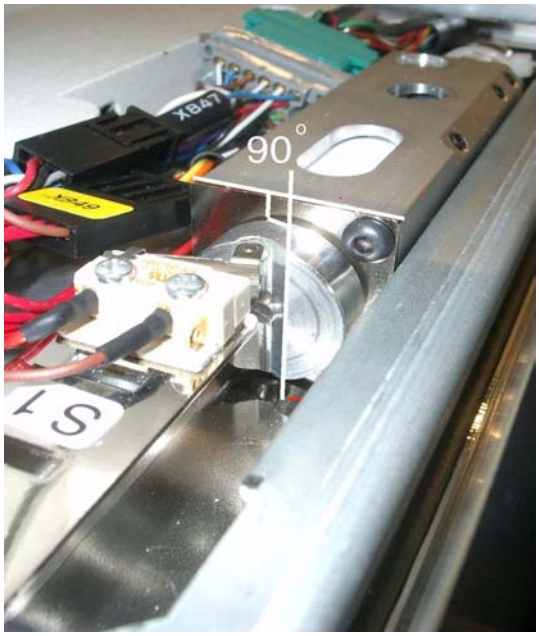


Fig. 7 Adjust grid motor wheel

3. Move the grid to the right end position.
4. Check if the slits are horizontal to the detector table (see Fig. 7).
5. If the slits isn't horizontal, loosen the screw on the wheel and adjust it so the slits is horizontal in both end positions.

Adjust the grid location

1. Open the carbon detector cover.
2. Make sure the grid in mounted in parallel to the detector and lined up to the front of the table. The front switch has to be engaged.

Checking Image Quality

While calibration is typically performed by the customer as part of normal system operation, calibration information is provided in the event that you are required to perform a system calibration.

To calibrate the system proceed as follows:

- First perform a **calibration of the detector** and check the images for bad pixels.
- If you observe any bad pixels, perform a **creation of the pixel map** and do a **calibration of the detector** afterwards.

If you have to troubleshoot an image quality problems, please see the chapter "Troubleshooting Image Quality" on Page 12 - 1.

Calibration of detector

The detector captures charge in its TFT, which is then carried as an electronic signal through charge amplifiers and analog-to-digital conversion to generate a digital signal. While the charge amplifiers are matched, small differences in their performance can result in differences in the X-ray densities detected for the same amount of X-ray.

Performing calibration allows the system to detect these small differences, along with other variables that can affect the digital signal output. The system can then apply adjustments to the output data to compensate for these differences.

When to Calibrate the detector

Calibration of the detector must be done:

- Once every two weeks.
- When the Detector has been powered off.

NOTE	**Calibration must not be performed for at least one hour "after" the Detector has been powered on to allow it to warm up.**

- When the room temperature has varied more than **±3°C** (±5.4°F) from the last calibration.

Proceed as follows:

NOTE	**Make sure that no patient is registered before you start the Gain Calibration.**

1. Log into local service **Options -> Service -> Local Service.**

NOTE	**The Service Level 1 or higher is necessary to do the Gain Calibration.**

2. Select **Acquisition System.**

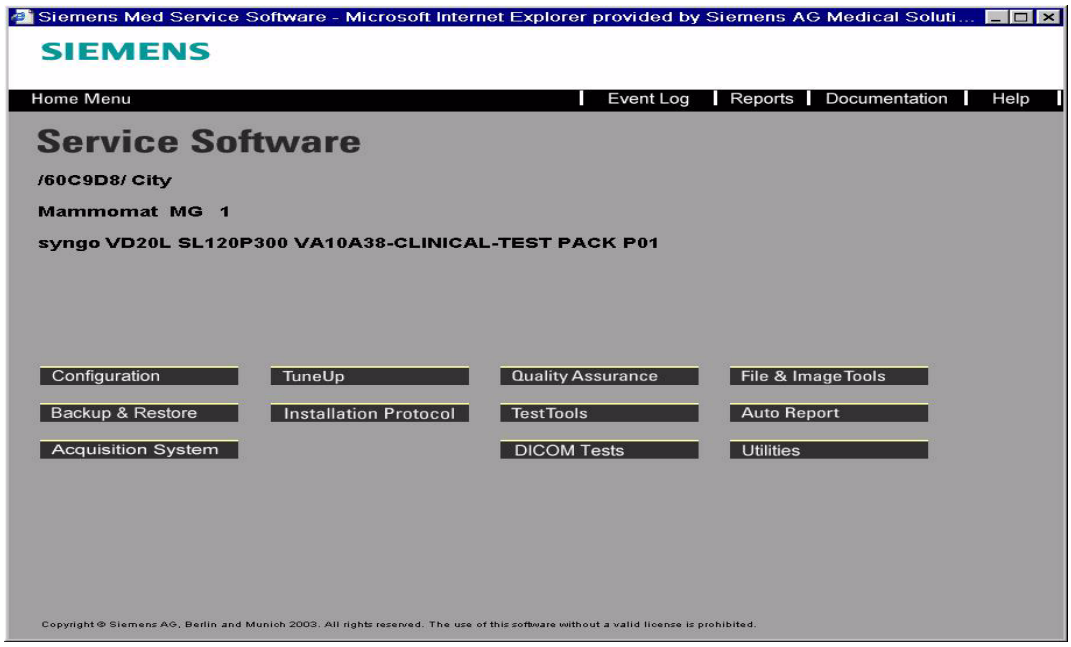


Fig. 8 Service Home Page

3. As a result you will get the following screen.

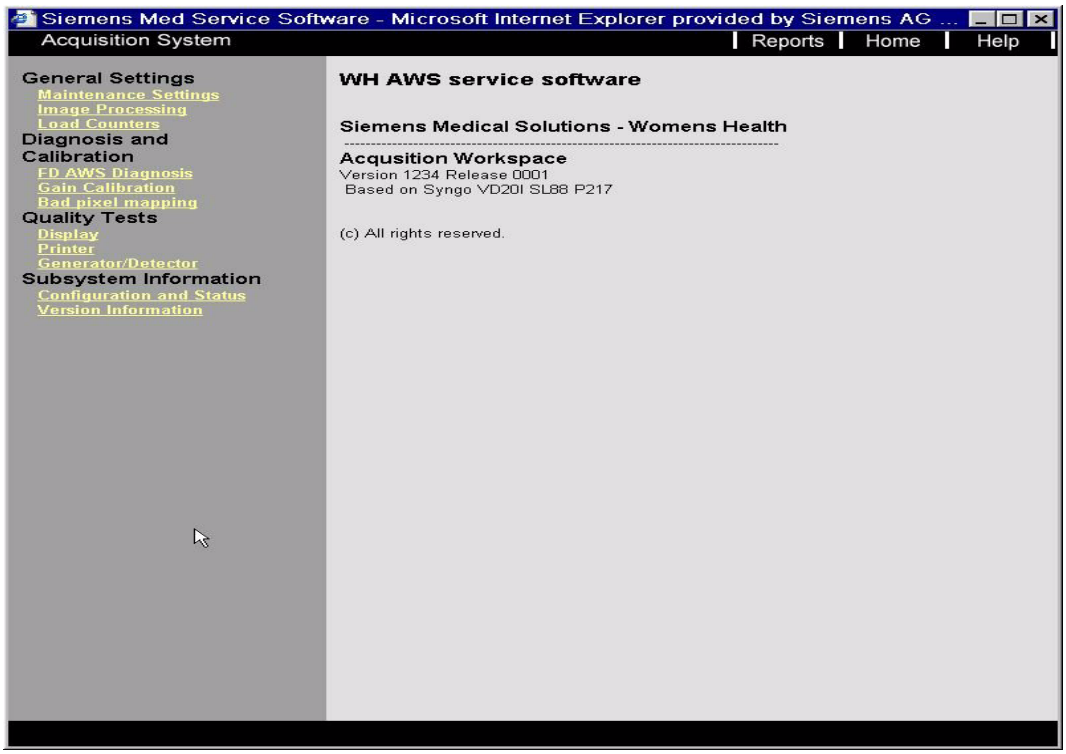


Fig. 9 Acquisition System Menu

4. Select **Gain Calibration**. The data from the last Calibration will be displayed.

⚠WARNING **After pressing the Start button the last calibration data will no longer be valid.**

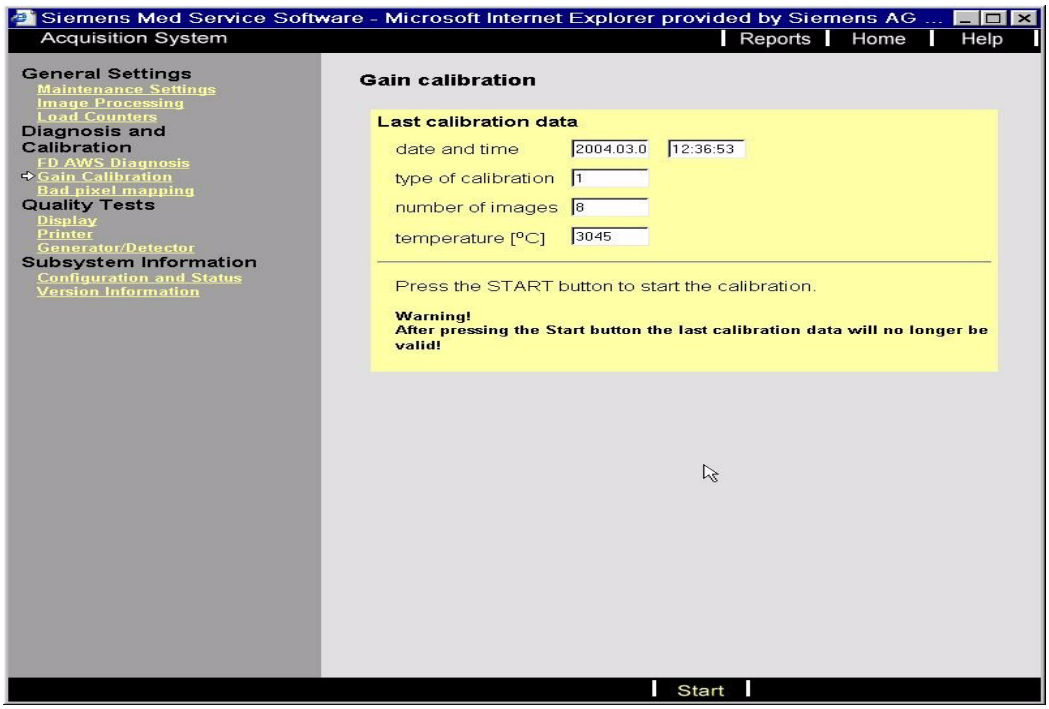


Fig. 10 Calibration - Enter

NOTE **The "temperature" field in this picture shows a value of "3045", due to a bug in the software.**

The actual temperature value is "30.45".

5. Press the **Start** button, to start the calibration.

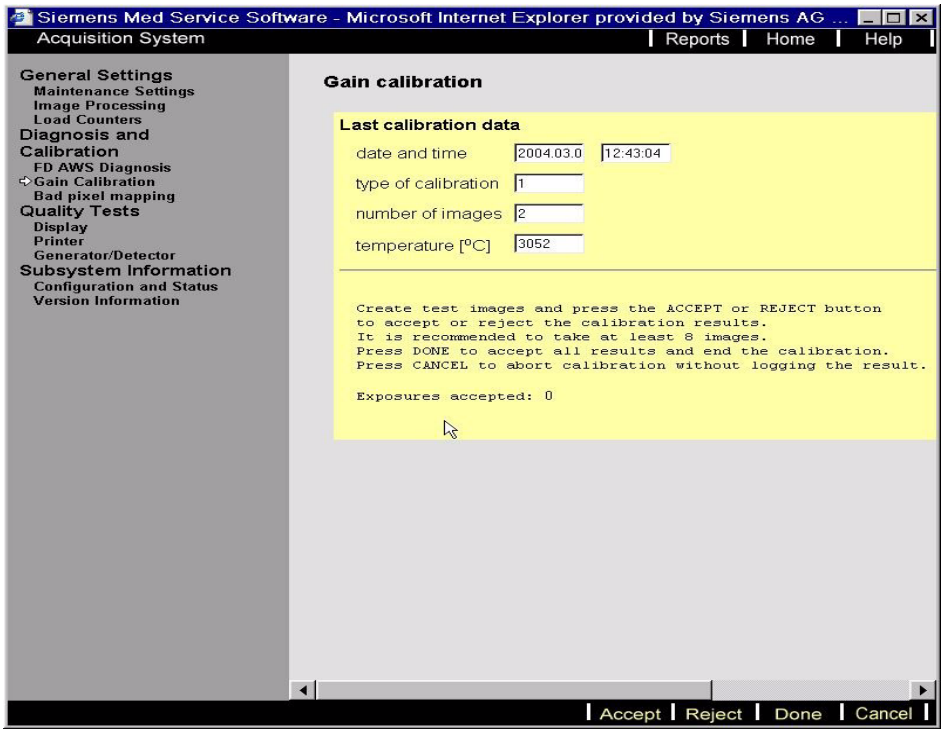


Fig. 11 Calibration - Start

6. Create or register the patient **Calibration** and submit with **Exam**.

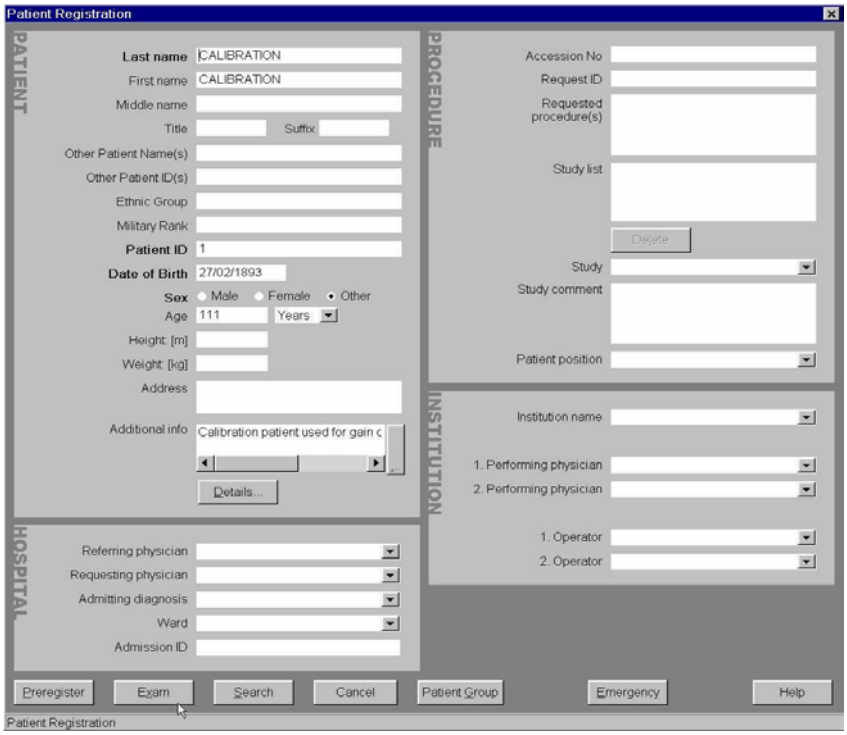


Fig. 12 Calibration - Patient register

7. Select the Procedure **Calibration** from the examination tab card.

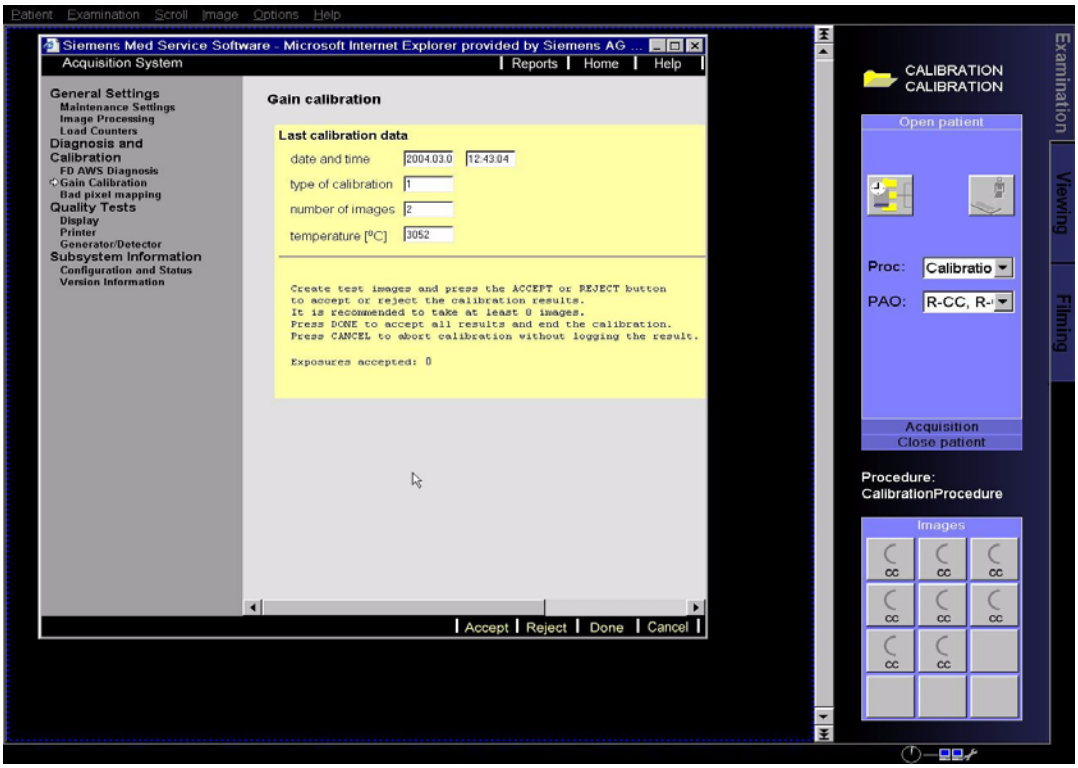


Fig. 13 Start Calibration

NOTE	**Remember, you can always add or remove images to the "Procedure" by using the right mouse click.**

8. Set the following exposure parameter on the control console of the MAMMOMAT Novation DR:

   Mo/Mo, 28KV, 250mAs

9. Insert the collimator mounted plexi phantom.
10. Mount the compression plate simulator.
11. Double click on the **first** Image of the 8 at the **Procedure: Calibration Procedure**
12. Start an exposure.
    Wait until the image is loaded into the viewer. The following lines are displayed in the message bar.

    Image acquisition is in progress .....

    Saving processed Image .....

    Loading Image .....

13. Check the image quality of the image. No objects or artifacts shall be visible in the image.

    If you **Accept** the image, the image will be used for Gain Calibration.

If you **Reject** the image, a new image can be acquired for the Gain Calibration. Correct the problem select the same image from the **Procedure: Calibration Procedure** and continue with step 12.

NOTE **You would "Reject" an image if it exhibits any edge cut-off due to collimation or misalignment or if there are any artifacts from debris or obstructions.**

14. Wait approximately 10 seconds for the image to be calculated (observe the status bar) and then double click on the next image in the **Procedure: Calibration Procedure** and proceed with step 12 until you have a total of 8 images.
15. Click **Done** to exit the Calibration.
16. Close the examination.

Creation of new pixel map

During the calibration function, you have the option of creating a new pixel map of the detector. The pixel map indicates which pixels in the Detector's array might not be reading X-ray densities correctly and so should be ignored when the image is acquired. This is similar to a bad spot map for a computer's hard disk.

A new pixel map should be created when an excessive amount of pixel dropout is occurring repeatedly on images displayed in the Image Preview window.

To create a new pixel map:

NOTE **Make sure that no patient is registered before you start the Bad Pixel Mapping.**

1. Log into local service **Options -> Service -> Local Service.**

NOTE **The Service Level 5 or higher is necessary to do the Bad Pixel Mapping.**

2. Select **Acquisition System.**

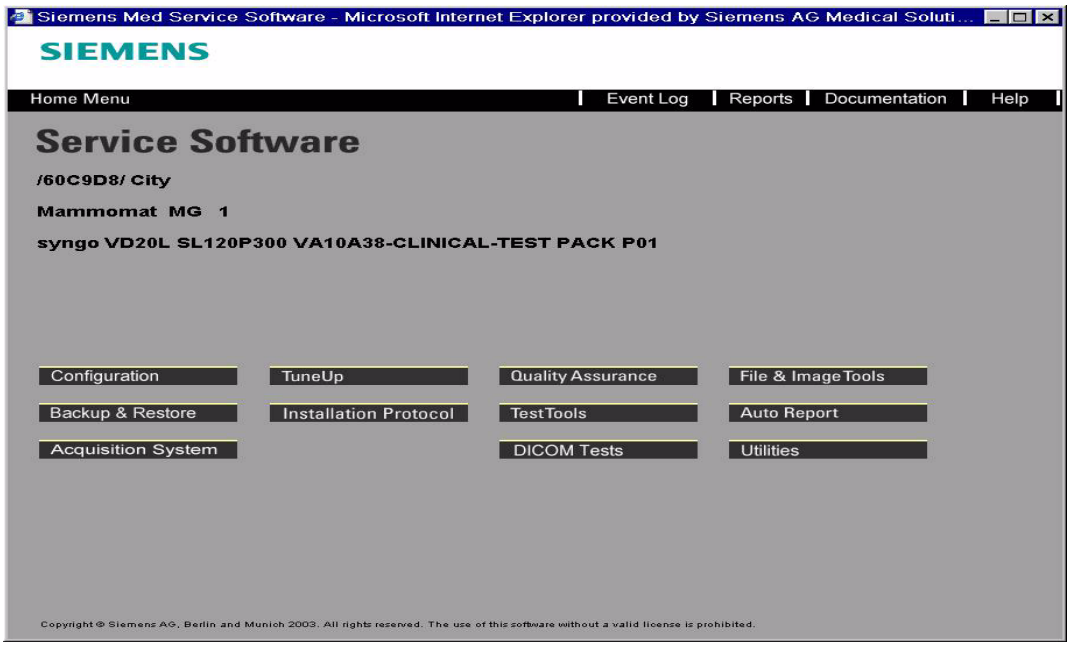


Fig. 14 Service Home Page

3. As a result you will get the following screen.

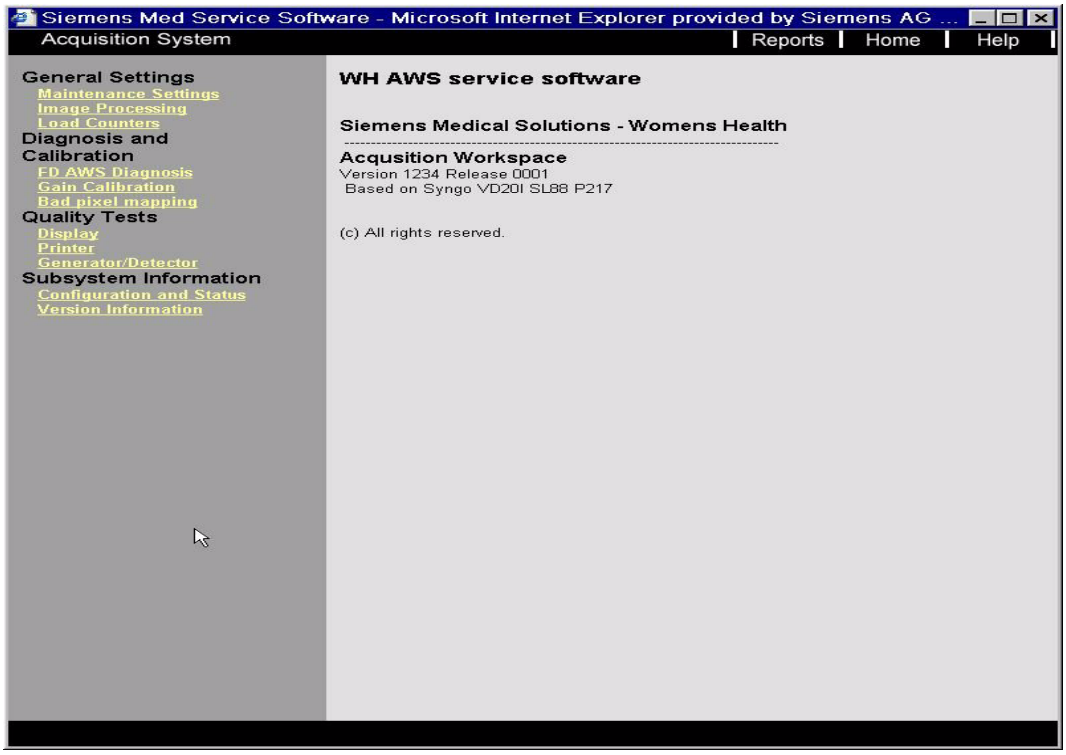


Fig. 15 Acquisition System Menu

4. Click the **Bad pixel mapping** link.

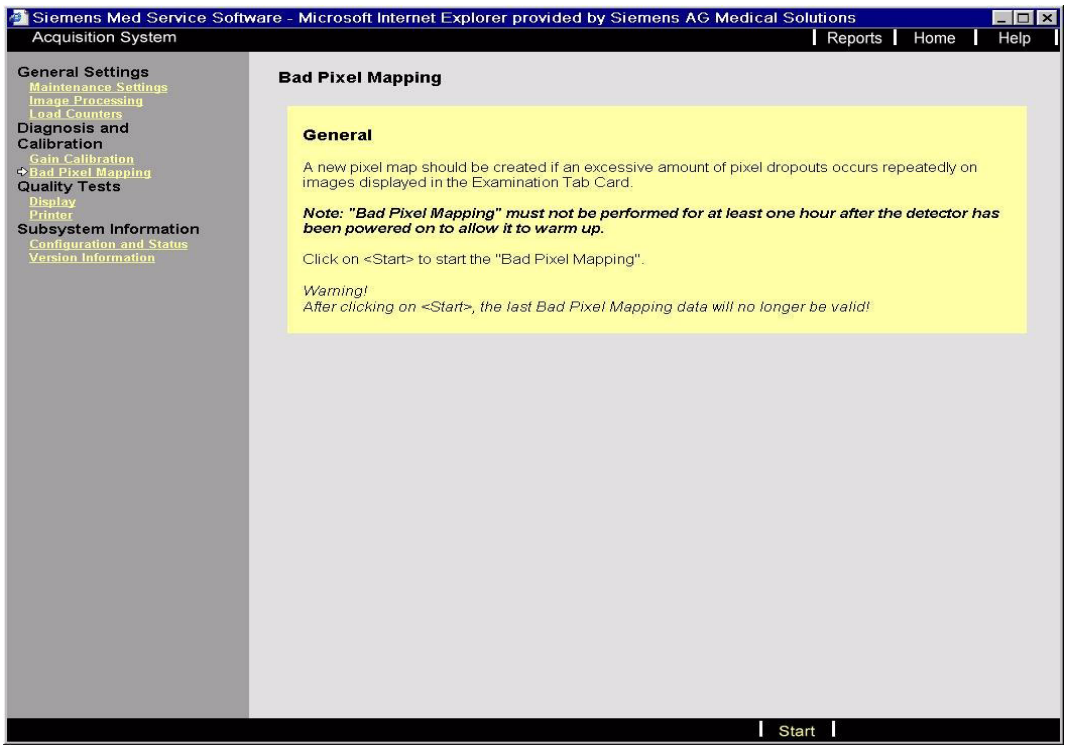

Siemens Med Service Software - Microsoft Internet Explorer provided by Siemens AG Medical Solutions
Acquisition System
Reports
Home
Help
General Settings
Maintenance Settings
Image Processing
Load Counters
Diagnosis and Calibration
Gain Calibration
Bad Pixel Mapping
Quality Tests
Display
Printer
Subsystem Information
Configuration and Status
Version Information
Bad Pixel Mapping
General
A new pixel map should be created if an excessive amount of pixel dropouts occurs repeatedly on images displayed in the Examination Tab Card.
Note: "Bad Pixel Mapping" must not be performed for at least one hour after the detector has been powered on to allow it to warm up.
Click on <Start> to start the "Bad Pixel Mapping".
Warning!
After clicking on <Start>, the last Bad Pixel Mapping data will no longer be valid!
Start

Fig. 16 Bad Pixel Mapping - Enter

5. Press the **Start** button, to begin with the Bad Pixel Mapping. As a result the following screen is displayed

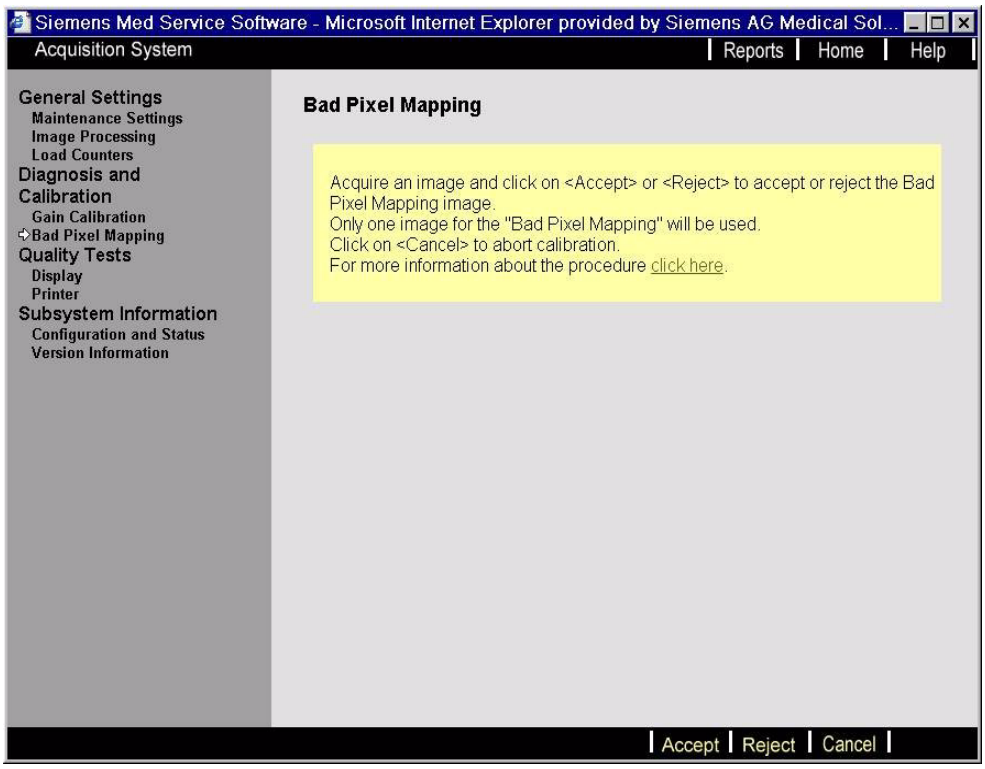


Fig. 17 Bad Pixel Mapping - start

NOTE	**If you want to end the Bad Pixel Mapping operation at this point, click the "Cancel" button.**

6. Register the pre defined patient **Calibration** and submit with **Exam**.

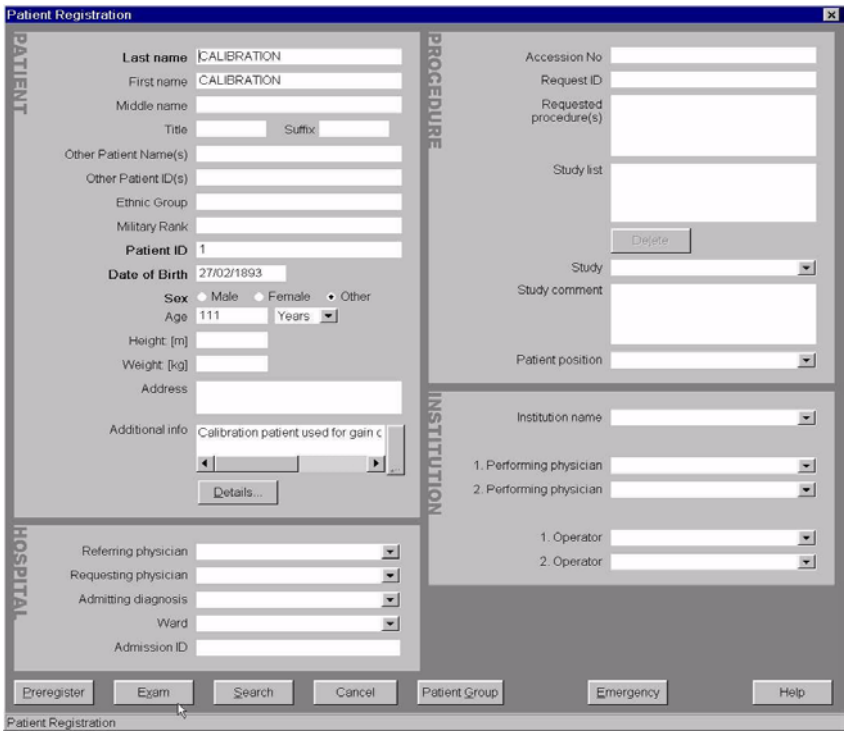


Fig. 18 Bad Pixel Mapping - Patient register

7.

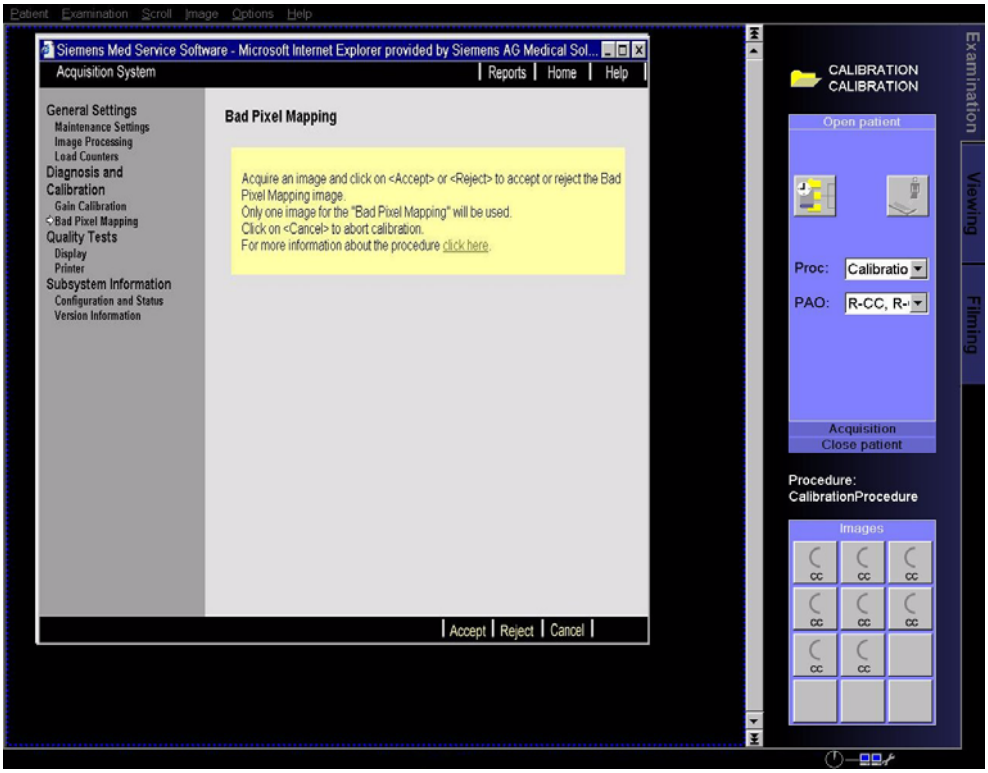


Fig. 19 Acquisition System Menu

NOTE	**If you want to end the Bad Pixel Mapping operation at this point, click the "Cancel" button.**

8. Set the following exposure parameter on the control console of the MAMMOMAT Novation DR:

   Mo/Mo, 28KV, 250mAs

9. Insert the collimator mounted plexi phantom.

10. Mount the compression plate simulator.

11. Double click on the **first** Image of the 8 at the **Procedure: Calibration Procedure**

12. Start an exposure.
    Wait until the image is loaded into the viewer. The following lines are displayed in the message bar.

    Image acquisition is in progress .....

    Saving processed Image .....

    Loading Image .....

13. Click the **Accept** or **Reject** button.

If you **Accept** the image, the new pixel map is created. No further images have to be taken.

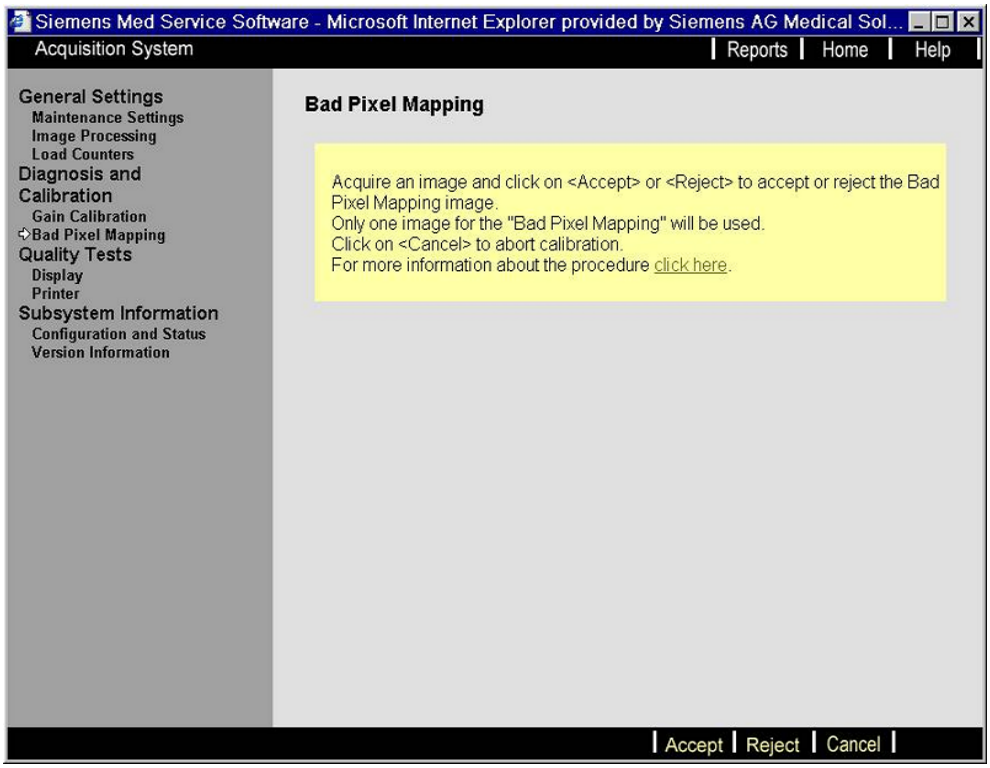


Fig. 20 Bad Pixel Mapping - Accept Image

NOTE	**If you want to end the Bad Pixel Mapping operation at this point, click the "Cancel" button.**

If you **Reject** the image, the Bad Pixel Mapping menu is displays. Correct the problem and return to step 12.

NOTE	**You would "Reject" an image if it exhibits any edge cut-off due to collimation or misalignment or if there are any artifacts from debris or obstructions.**

14. Click **Done** to exit the Bad Pixel Mapping.
15. Close the examination.

Quality Control Manual Tests

Perform the annual acceptance tests, except **Beam quality (HVL)** test, of the **Quality Control Manual (**Part of the **User Manual** SPB7-250.620...**)** and fill out the **Test Protocol** (part of the Quality Control Manual) accordingly.

Remarks to the Quality Control tests:

- **Tube voltage measurement & reproducibility**
  The Quality Control manual suggests to use a non-invasive kV meter. If you don't have such a measurement device in your district office, use a scope to measure the kV. Connect the oscilloscope as follows:

  Channel 1 to measuring point **HV_ACT** **(actual value)** (1 V = 5 kV) on the D750.

- **Beam quality (HVL)**
  The HVL values are supplied with the system and don't have to be measured again with the first installation of the system. You need the HVL for the **Mean glandular dose test** and you can find them in the binder ...

- **"QC Raw" and "QC Processed" procedures**
  To do the QC manual the **QC Raw** and the **QC Processed** procedures are necessary.

  1. Check if both procedures exist in the WH AWS application software.

     Options -> Configuration -> Proc Hand

     If they don't exist you have to create them as follows:

  2. Add the **QC Raw** procedure with the following parameters in the **Proc Hand** application:

Projection Views:	**Add 10 R-CCs**
Examination Operating Program:	**CalibrationOP**
Examination purpose:	**Unprocessed**

  3. Add the **QC Processed** procedure with the following parameters in the **Proc Hand** application:

Projection Views:	**Add 10 R-CCs**
Examination Operating Program:	**CalibrationOP**
Examination purpose:	**Screening**

Other issues

You'll find the Quality Control documentation in the **Instruction for Use** binder. It is shipped with the system.

Depending on the location of the installation the corresponding **Quality Control Manual** has to be used.

- For the **USA** the Quality Control Manual (SPB7-250.623.02.xx.24) has to be used.
- For the **ROW** (Rest Of The World) the Quality Control Manual (SPB7-250.623.02.xx.02) has to be used.

Make a note in the "Startup Protocol" on Page 11 - 1, that the Quality Control Manual tests have been performed**.**

Settings date and time

MAMMOMAT Stand

Prerequisite

- The correct date and time must be set in the service PC. If not, set the date at C:\> by typing **date** <ENTER> and the time at C:\> by typing **time** <ENTER>**.**

Test performance

1. Start the Service Software for the MAMMOMAT Stand on the Service PC.
2. In the **Mainmenu** select **Configuration** ⇨ **Clock.**

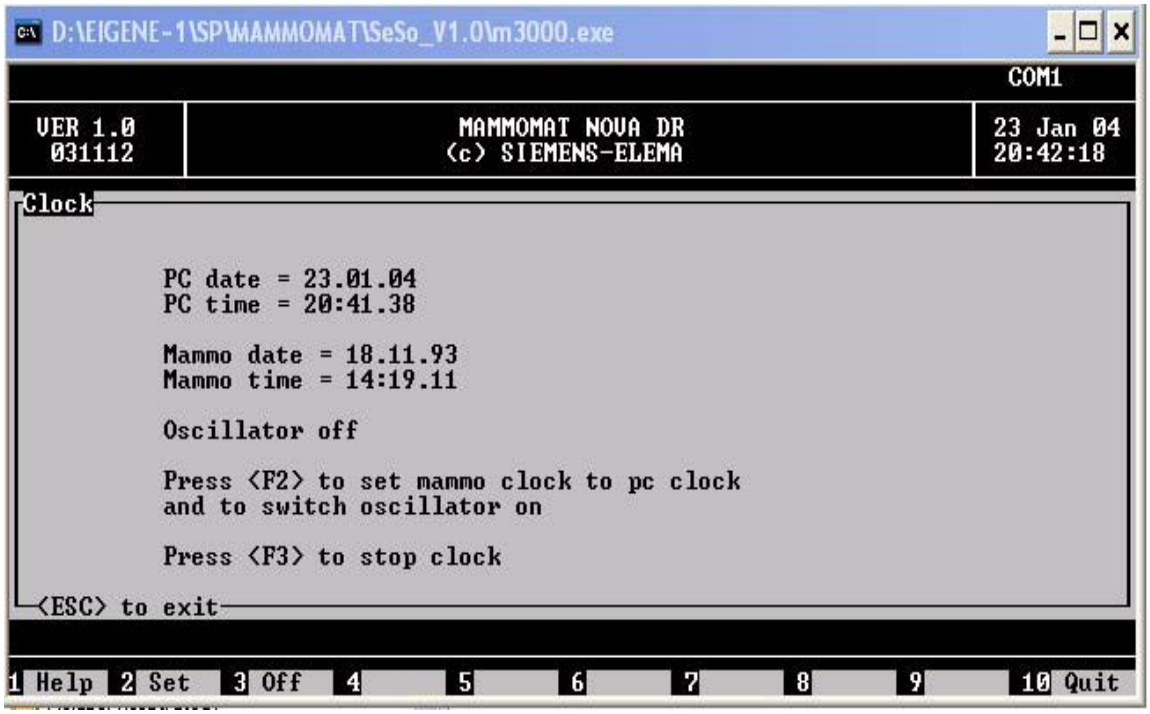


Fig. 1 MAMMOMAT Stand clock adjustment

3. Press **<F2>**.
   With **<F2>** the date and time set in the service PC are taken over by the MAMMOMAT stand.

BRICK

Setting the date and time on the BRICK.

1. Go into the service software and select **Utilities -> Escape to OS** and enter the following command in the **Command** field.

   start telnet brick

2. A Username and Password have to be entered.

   Username: **root**

   Password: ******

3. To see what the current date and time setting on the BRICK is, use the following command:

   brick# **date**

   To set the date and time on the BRICK, use the following command:

   brick# **date mmddHHMMyy**

   mm - month

   dd - day

   HH - hours

   MM - minutes

   yy - year

   The following example sets the system to 3:10 p.m. on November 21, 2004:

   brick# **date 1121031004**

Service PC and measuring instruments

Saving the configuration file

NOTE	Make sure that the backup floppy is inserted.

Main menu:

1. Select **Configuration ⇨Save config file**.
2. Press <F2> to save data.

Reset the exposure counter

Main menu:

1. Select **Service ⇨Reset exposure counter**.
2. Delete the error memory with <Y>.

Deleting the error buffer

Main menu:

1. Select **Service ⇨Delete error buffer**.
2. Delete the error memory with <Y>.

Saving the MAMMOMAT Parameters

Main menu:

1. Select **Backup ⇨Copy installation area to floppy ⇨All**.
2. Leave the program with <F10> when the backup is ready.

NOTE	Keep the backup floppy with other documentation for the MAMMOMAT *Novation*^{DR} in question.

Remove the measuring instruments

1. Turn **OFF** the MAMMOMAT.
2. Remove the service PC.
3. Remove connected measuring instruments.

Checking the protective grounding resistance

Using the protective ground wire tester, measure the resistance between the protective ground terminal in the stand (Mains input terminal) and all metallic parts of the equipment which the patient/operator may come in contact with, incl. all object tables.

The protective ground resistance must not exceed **0.1 Ω**.

Warning label on control panel

The control panel warning label comes in eleven languages; English, German, French, Spanish, Italian, Dutch, Danish, Norwegian, Finnish, Greek, and Swedish. The warning labels are found in a plastic bag under thumb index 3 in the Technical Manual.

NOTE	**Warning label in English is provided on delivery.**

Choose the appropriate language and affix the label over the existing label on the control panel, see Fig. 2. Be sure to position the label properly before affixing it. The label sticks immediately.

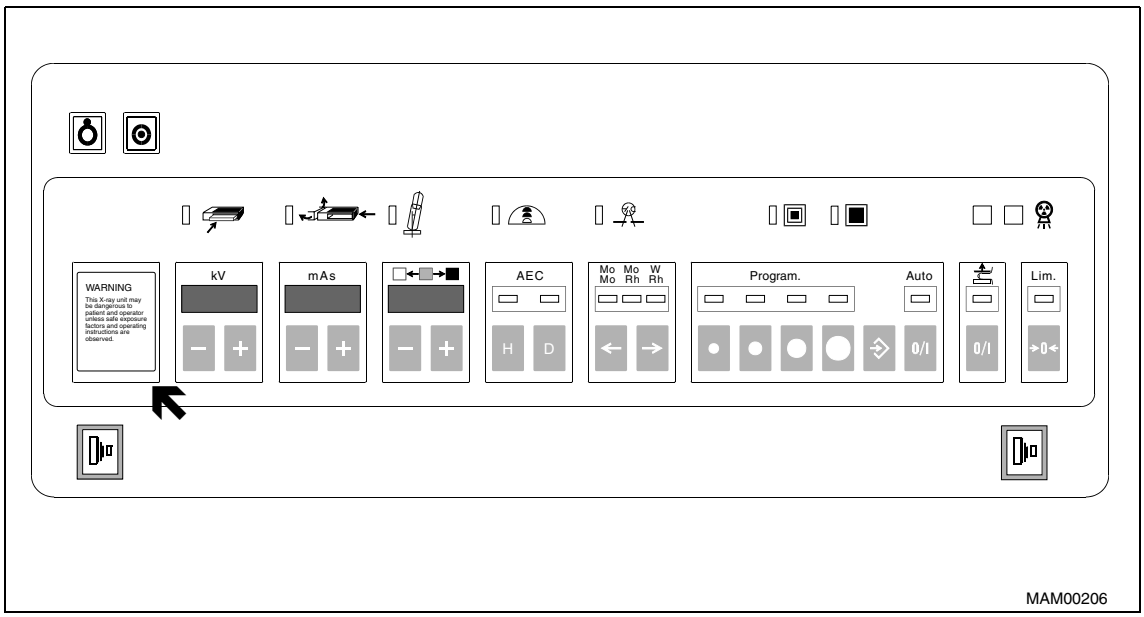


Fig. 2 Warning label on control panel

Quality Certificate

- The SP Q "**Quality Certificate"** has to be filled out, signed. The form can be found in the chapter 9 "**Certificates**" of the technical documentation binder (Appendix of 66 46 900 QZE 01S 00). It has to be send to the address stated on the certificate, only when Installation or Start up problems occurred. Place a copy of the SP Q Quality Certificate in the technical documentation binder.
- The **Startup Protocol** and the **Installation Protocol** remain with the system.

Site Data

SAP No.: _____ System Ser. No.: _____

Customer: _____

Country/city: _____

Installation team: _____

Project manager: _____

Installation start: _____ Installation end _____

Auxiliary Materials used

Item	Model	Calibration date	Serial number
Oscilloscope >50MHz with memory			
Digital multimeter including an mAs meter			
Power line impedance meter			
Power ground-wire tester			
Luminance meter (for monitor calibration)			
Luminance meter (measures the light intensity from the X-ray field)			
Dose meter			
Ion chamber			
Densitometer			
A non-invasive digital kV meter			

Tab. 1 Auxiliary materials

Installation and Start up steps performed

	Work performed	
	yes	no
Installation:		
The MAMMOMAT *Novation*^{DR} was installed completely	❑	❑
All Covers are mounted.	❑	❑
The temperature logger was sent to DirectRay Cooperation (DRC)	❑	❑

	Work performed	
	yes	no
Start up:		
Check power supply voltages	❑	❑
Mechanical checks performed	❑	❑
X-Ray tube checks performed	❑	❑
Collimator checks performed	❑	❑
Dose Settings checked	❑	❑
Acquisition Workstation configurations performed	❑	❑
Configured DICOM services	❑	❑
Image Quality tests performed	❑	❑
Acceptance tests performed	❑	❑
Ground wire tested	❑	❑
Line resistance tested	❑	❑
Backup for Acquisition Workstation and MAMMOMAT created	❑	❑
SP Q "Quality Certificate" filled out and sent, when problems occurred with either the Installation or Start up.	❑	❑

Startup Settings

Tube high voltage, current and mAs values

Results from the chapter "Tube high voltage, current and mAs values" on Page 6 - 1.

kV mAs Anode/ filter	Measured values	Result kV must be ±5% mAs must be ±10%
○ 30 kV 20 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 30 kV 20 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 35 kV 100 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 35 kV 100 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 25 kV 100 mAs, Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 25 kV 100 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
● 30 kV 10 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs

Tab. 2 Tube high voltage, current and mAs values

kV mAs Anode/ filter	Measured values	Result kV must be ±5% mAs must be ±10%
● 30 kV 10 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
○ 25 kV - Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs Display _____ mAs
○ 25 kV - W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs Display _____ mAs

Tab. 2 Tube high voltage, current and mAs values

Collimator beam calibration

Results from the chapter "Collimator beam calibration" on Page 7 - 2.

Focus and Anode	XL	XR	YC	YS
Small focus molly				
Large focus molly				
Small focus tungsten				
Large focus tungsten				

Tab. 3 Collimator beam calibration

Collimator field light calibration

Results from the chapter "Collimator field light calibration" on Page 7 - 4.

	XL	XR	YC	YS
Light field				

Tab. 4 Collimator field light calibration

Collimator wing difference

Results from the chapter "Collimator Wing Difference Calibration" on Page 7 - 5.

	XL	XR	YC	YS
Wing difference				

Tab. 5 Wing difference

AEC Dose Settings

Results from the chapter "Checking the AEC dose settings" on Page 8 - 4.

AEC	kV	Anode / Filter	Dose value	Pixel value
H	**28 kV**	**Mo/Mo**		
D				
H		**Mo/Rh**	**-**	
D			**-**	
H		**W/Rh**	**-**	
D			**-**	

Tab. 6 AEC Dose Settings

OPDOSE Settings

Results from the chapter "Checking OPDOSE" on Page 8 - 3.

Program button	Thickness	kV	Anode/filter combination	AEC
1				
2				
3				
4				

Tab. 7 OPDOSE Settings

Checking Grid Lines

Results from the chapter "Checking Grid Lines" on Page 9 - 1.

Expo-sure	Exp Mode	mAs	PMMA / mm	Tube Angle	visible grid lines (yes/no)	X	Y	Mean pixel value differ-ence [%]
1	mAs	32	30	0^o				
2	mAs	56	40	0^o				
3	mAs	200	60	0^o				
4	AEC "H"	-	40	0^o				
5	AEC "H"	-	40	$+ 60^o$				
6	AEC "H"	-	40	$- 60^o$				

Tab. 8 Measuring Grid Lines

Activity report

Day	Start	End	E	M	V	R	KA	Work performed	Employees/ number
Total (Mh)									

Explanation of the activity report

Day / Start / End	Date / start of work / end of work (time)
E	Bringing in the entire system in hours per/day
M	Installation of the entire system in hours per/day
V	Cabling of the system in hours per/day
R	Travelling time in hours per/day
KA	No order-related working time in hours per/day
Work performed	Work performed in the time
Employees/number	Number of employees who were employed in the period
Total (Mh)	Man hours, number of accumulated hours multiplied by number of employees

General remarks

A copy of this remains at the system and is filed in the Assembly/Installation folder.

Place, date	Installation team employee	Siemens project manager/ person responsible for the project
	Name in block letters	Name in block letters

This page intentionally left blank.

Troubleshooting Image Quality

Various components, when operating incorrectly, can yield a variety of unacceptable imaging artifacts. These artifacts can come from anywhere along the chain of image capture, conversion, and display. The tables in this topic suggest the causes and corrective responses for particular problems.

A key step in analysis is to isolate the artifact to the component that is producing it. First, similar appearing artifacts can come from anywhere in the overall image chain. Second, the tendency to assume that the artifact is coming from the least known component must be avoided. For example, artifacts that appear to be coming from the detector may actually be coming from the output device or processing.

Isolation is the first step and should be done by using internally-generated image patterns in the image chain to determine where exactly the artifact is being produced (“what is/what is not” the artifact analysis).

The following tables provide direction for cause and corrective action for those artifacts that have been validated as coming from various components.

Line Artifacts		
Problem	**Cause**	**Recommended Action**
Line Parallel to the Short Axis	Seam: • Seam correction algorithm not turned on; wrong algorithm selected. • Detector gain not calibrated properly. • Seam (lines 1535 and 1536) needs to be mapped out. Source lines: • detector not calibrated properly. • Line needs to be mapped out.	• Perform detector calibration procedure (refer to "Calibration of detector" on Page 9 - 8). • Perform detector calibration procedure (refer to "Calibration of detector" on Page 9 - 8). • Perform the bad pixel correction. (refer to "Creation of new pixel map" on Page 9 - 14)
Line Parallel to the Long Axis	Line ends at seam or line partially defective (gate lines). • Detector not calibrated properly. • Line needs to be mapped out.	• Perform detector calibration procedure (refer to "Calibration of detector" on Page 9 - 8). • Perform the bad pixel correction. (refer to "Creation of new pixel map" on Page 9 - 14
Line Runs Through Seam	• Read out problem; HV setting time too short. • Hard copy device or processor artifact.	• Follow applicable problem solving.

Random Artifacts		
Problem	**Cause**	**Recommended Action**
Increase in Defective Pixels and Lines	Defective pixel file requires updating.	• Perform the bad pixel correction. (refer to "Creation of new pixel map" on Page 9 - 14)

Structured Artifacts		
Problem	**Cause**	**Recommended Action**
Appearance of 24 "256 blocks" of different Densities or Counts	Gain calibration not turned on. Detector not calibrated properly.	Follow calibration procedure.
Image not appearing in One or More "256 blocks"	Detector defective.	Detector might have to be replaced contact the Service Center.
Image not appearing in one or more quarters of Detector	Detector defective.	Detector might have to be replaced contact the Service Center.
Garbled, scrambled, or truncated (from edges of long axis in) images	Poor cable connection. Electronic interference with or along cable.	Check pins and Detector connection to PXCM. Identify and isolate sources of interference; examine the cable pathway.
Fine Linear Pattern, Parallel to Long Axis, in One or More "256 Blocks" (usually more pronounced on an edge)	Electromagnetic noise interfering with Detector Read Out.	Shield Motors, power sources, and so on, located in proximity to the detector.

Other Artifacts		
Problem	**Cause**	**Recommended Action**
White lines towards the center of panel (Bar Code)	Detector defective.	Detector might have to be replaced contact the Service Center.
Dark lines / weak lines	Lines need to be mapped out.	Contact the Service Center.
Poor image quality	Detector not calibrated to optimal operating temperature.	Allow proper warm-up time to normal operational temperature.
Distorted image with 256 blocks	Detector defective.	Detector might have to be replaced contact the Service Center.

Working with the service PC

Description of the syntax used in these instructions

<.....>	The indication of which function keys to press is given between these characters, for example <ENTER>, <ESC> etc.
CAPITALS	Capital letters indicate data which must be entered unchanged, for example the name of a register, file etc.
Italics	Italics represent data in which a value should be entered, e.g. for user name, the name of the technician should be entered.
[.....]	Square brackets enclose additions to commands which may be optionally entered.
Bold	Data relating to formats, user entries etc., which is important for the following entry, is shown in bold as it appears on the monitor screen.
_____	This character indicates that at this point the space key must be pressed.
xx yy zz	Data can be entered in place of *"x, y, z"* (e.g. day´s date).
{...}	Curved brackets indicate that out of several terms listed one below the other, one must be selected.
	Important remarks are indicated with this box.
* * * * *	When the password is entered, only these characters are shown.
Menu Selection:	When several menus, programs, files etc. are presented for selection, they are shown in a box (program window). Selection is made with the <↓> and <↑> keys. The module selected is highlighted in the display.
<ENTER>	Every entry must be confirmed with the <ENTER> key.
<ESC>	ESC allows paging back through the program.
<xx> + <y>	Some functions are selected by pressing two keys simultaneously. Procedure: Press, for example, the <Shift> key and keep it depressed, press the <*> key and then release both keys.
<F1>	Key <F1> calls up a selective help text.
<F10>	Key <F10> exits the program.
PLD	Programmable Logic Device on the AEC board (D701).
Flash	Memory device on the AEC board (D701).
OS	Operating System, e.g. "Microsoft® Windows®"

BIOS	Basic Input and Output System, a program stored in the computer hardware which launches start-up functions upon computer power-up.
XXX ⇨ XXX ⇨ XXX ⇨ XXX	This shows where a particular subroutine can be found. For example: **Main menu ⇨Configuration ⇨AEC ⇨Sensitivity correction**

Connecting the service PC

The service PC must be connected with connecting cable part no. 99 00 440 RE999 to the p.c. board in the generator (do not insert the diskette in the drive yet).

Configuration of the service PC

All Service Programs use the RS232 port in order to communicate with the MAMMOMAT. This port is usually handled as COM1 by the OS of the service PC. Modern PC's can be equipped with new types of communication hardware, e.g. infrared port and built-in modem, which may act as COM1 or share resources with COM1. This could cause malfunction of the Service Programs for the MAMMOMAT, which requires the OS and computer BIOS to be re-configured.

The following procedures are designed to ensure general compatibility with the OS's Windows® 2000 Pro on modern PC's. If the settings are saved, this procedure has to be done only once.

Configuration of computer BIOS

1. Enter the BIOS setup, usually done by pressing e.g. <F2> during the boot sequence of the BIOS.
2. Find the configuration of the IrDA (Infrared device) port and disable it.
3. Find the configuration of a built-in modem and make sure it is configured as COM3.
4. Find the configuration of COM1 and make sure it uses the interrupt IRQ 4 and the memory address range 03F8 - 03FF.
5. Save the BIOS settings and restart the PC.

Configuration of Windows® 2000 Pro

1. Choose Settings from the Start Menu.
2. Choose Control Panel.
3. Choose System.
4. Choose the tab Hardware.
5. Press the button Device Manager.
   If the IrDA-port was disabled in the computer BIOS, it should not be present in the list of available hardware. If the IrDA is present anyway and its icon is not marked with a red cross:
6. Double-click on the device row.

7. Choose the tab General in the dialog box that appears.
8. In the section Device Usage, change the status to "Disabled in the current hardware profile".
9. Exit the dialog by pressing the OK button.

Having performed the configurations described above, the Service Program should be able to communicate without difficulties.

Starting up and using the service PC

1. Switch on generator and service PC.
   After initialization, the service PC shows: **C:\>**
2. Now insert the diskette with the service program.
3. Select the appropriate drive {A:} {B:} and then press <ENTER>.
   The screen shows: **A:\>** or **B:\>**
4. Start the service program by typing 'SERVICE' (extension -c if you have a color display), then press <ENTER>.
   The program asks for the user's name: ***Your name, please***
   Type the name of the technician, for example NN, and then press <ENTER>.
5. The program asks for the password: ***Password, please***
   Type the password (********) and then press <ENTER>.
   The display window shows: ***Main menu***
6. Select the program part to be used with keys <↑> and/or <↓>, then press <ENTER>.
   The program part selected is shown with a background: ***Configuratio***
   If necessary, additional subroutines can be similarly selected here.
7. Make the necessary entries in the appropriate part of the program.
   Save the entered data with <F2>. Page back in the program with <ESC>.
   The appropriate instructions are shown on the monitor.
8. End the procedure with the service PC using <F10>.

Troubleshooting PC connection

If communication with the *MAMMOMAT Novation*^{DR} still cannot be established, follow the instructions in this section. The following procedure will disable the buffering of the RS232 port. This example is for Windows® 2000 Pro.

1. Choose Settings from the Start Menu.
2. Choose Control Panel.
3. Choose System.
4. Choose the tab Hardware.
5. Press the button Device Manager.
6. Expand the row Ports.
7. Double-click on the COM1 row.
8. Choose the tab Port Settings.
9. Press the button Advanced.

10. Uncheck the check box Use FIFO Buffers.
11. Exit the dialog by pressing the OK button.

This page intentionally left blank.

Changes to previous version 13 - 1

Chapter	Page	Change
-	-	n.a., initial version.

This page intentionally left blank.